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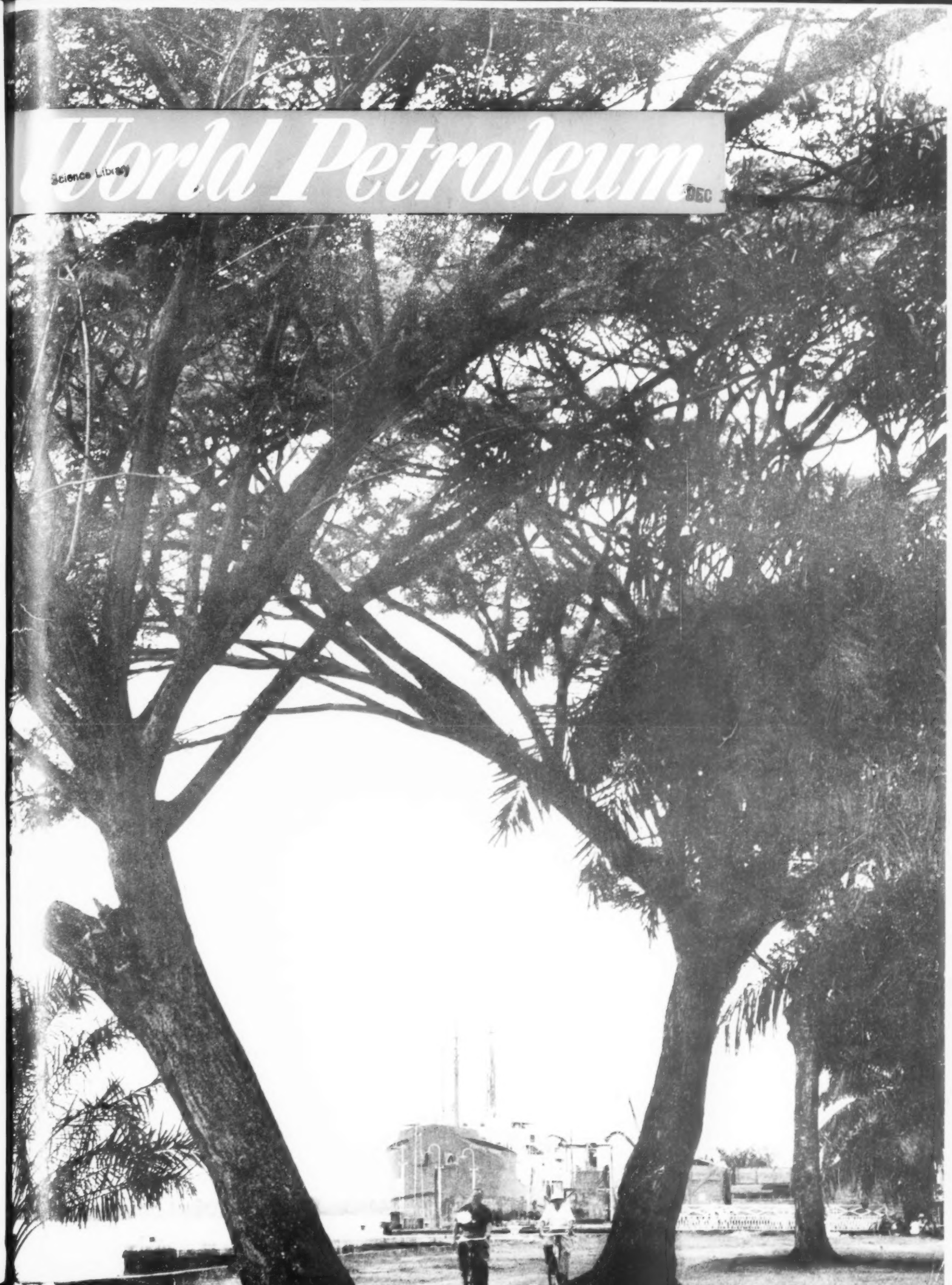

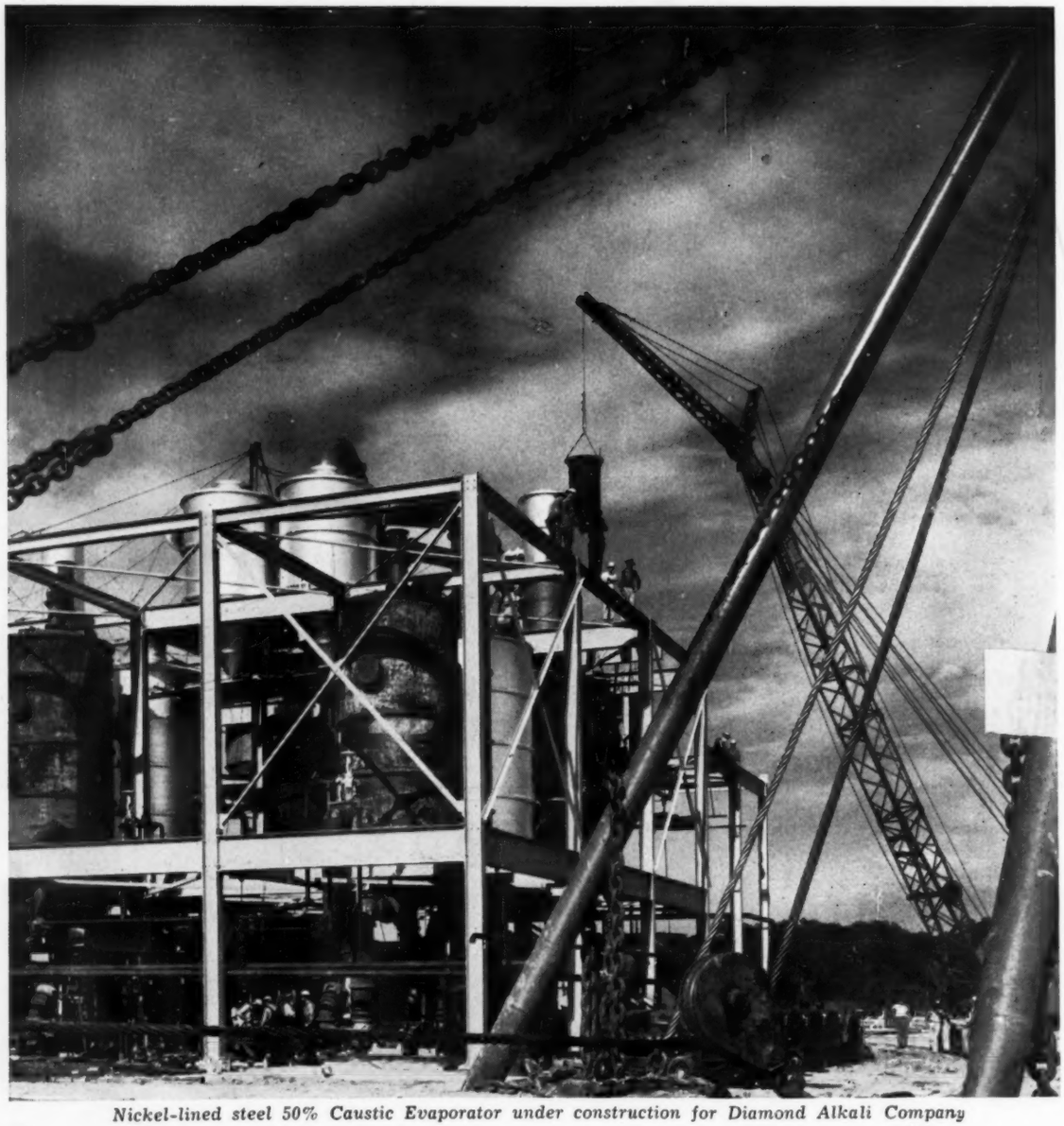

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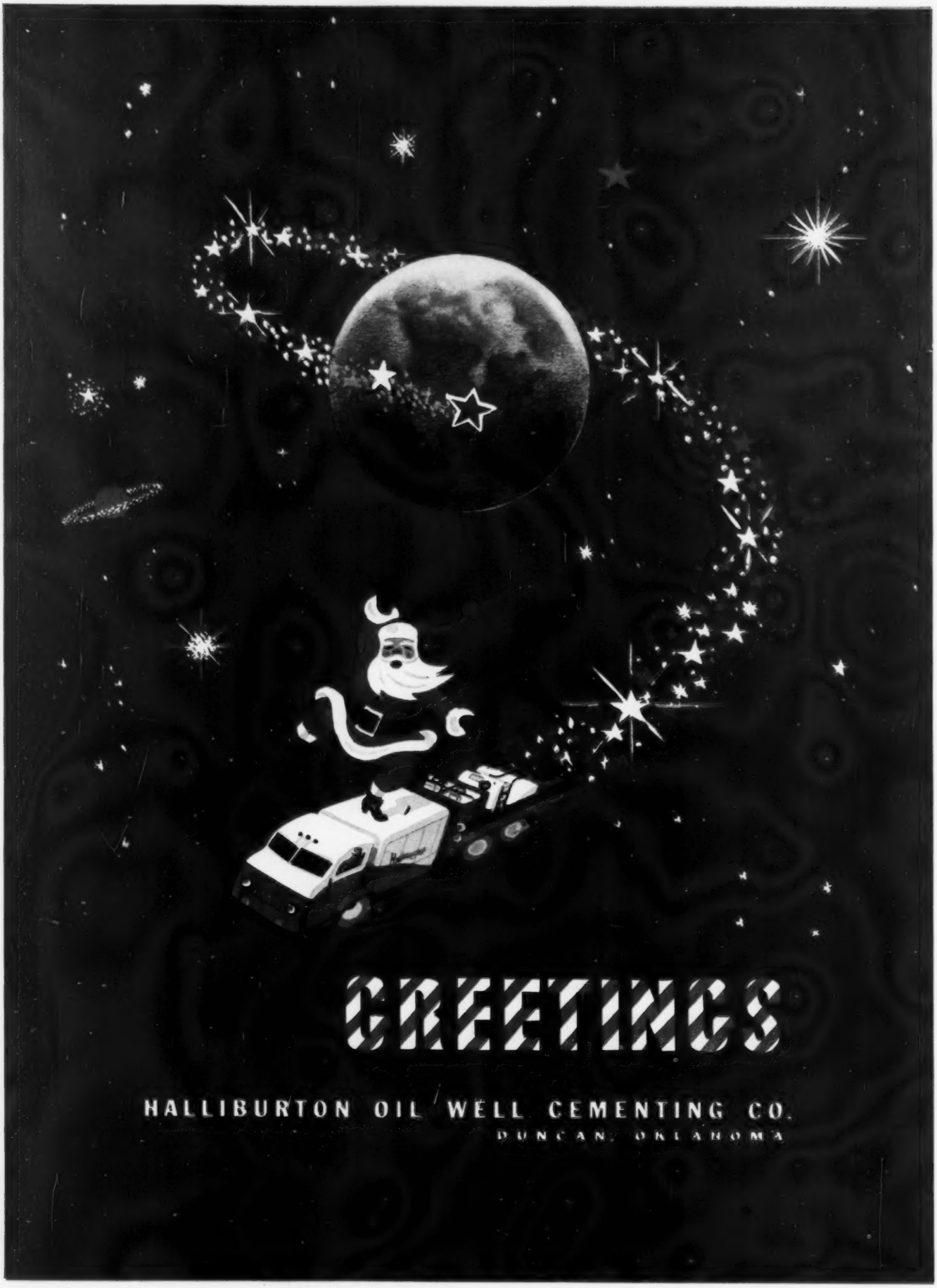
THIS MONTH'S COVER—The tanker Stanvac Pendopo framed between flame trees at the Soengi Gerong refinery of Standard-Vacuum Oil Co. near Palembang, Sumatra. An article describing current operations in producing fields of South Sumatra is published in this issue beginning on Page 42. Photo by Corsini for Standard-Vacuum.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EDITORIAL

OIL'S 1948 RECORD STRENGTHENS INDUSTRY POSITION

WHILE the oil industry must be on the alert, now and for many years to come, against attempts to impose government regulation and restrictions that would narrow its initiative and slow down the constant progress in efficiency maintained during its ninety years of existence, a glance backward over the twelve-month now approaching its close indicates that the likelihood of hasty and ill-considered legislation is less than it was a year ago. That this is so is due to the outstanding performance of the oil industry itself in raising production, improving distribution and building up a backlog of stocks adequate to all except the most abnormal conditions. Under the circumstances prevailing, this was no light task. Its successful accomplishment deserves to rank with the industry's earlier achievement in meeting the tremendous increase in demand for special products at the beginning of World War II.

At the close of the year 1947 and in the early months of 1948 the number of official probes into various phases of the oil business was as great probably as at any other time in the industry's experience. Many of the committee inquiries covered almost identical ground. Witnesses who appeared before such groups had to answer the same elementary questions, refute the same current misconceptions and explain away the fancied grievances of local distributors. From the number and similarity of hearings it was easy to form the impression that a concerted drive against the oil industry was under way, designed to put petroleum operations under a blanket of regulations that would end the exercise of free initiative and enterprise.

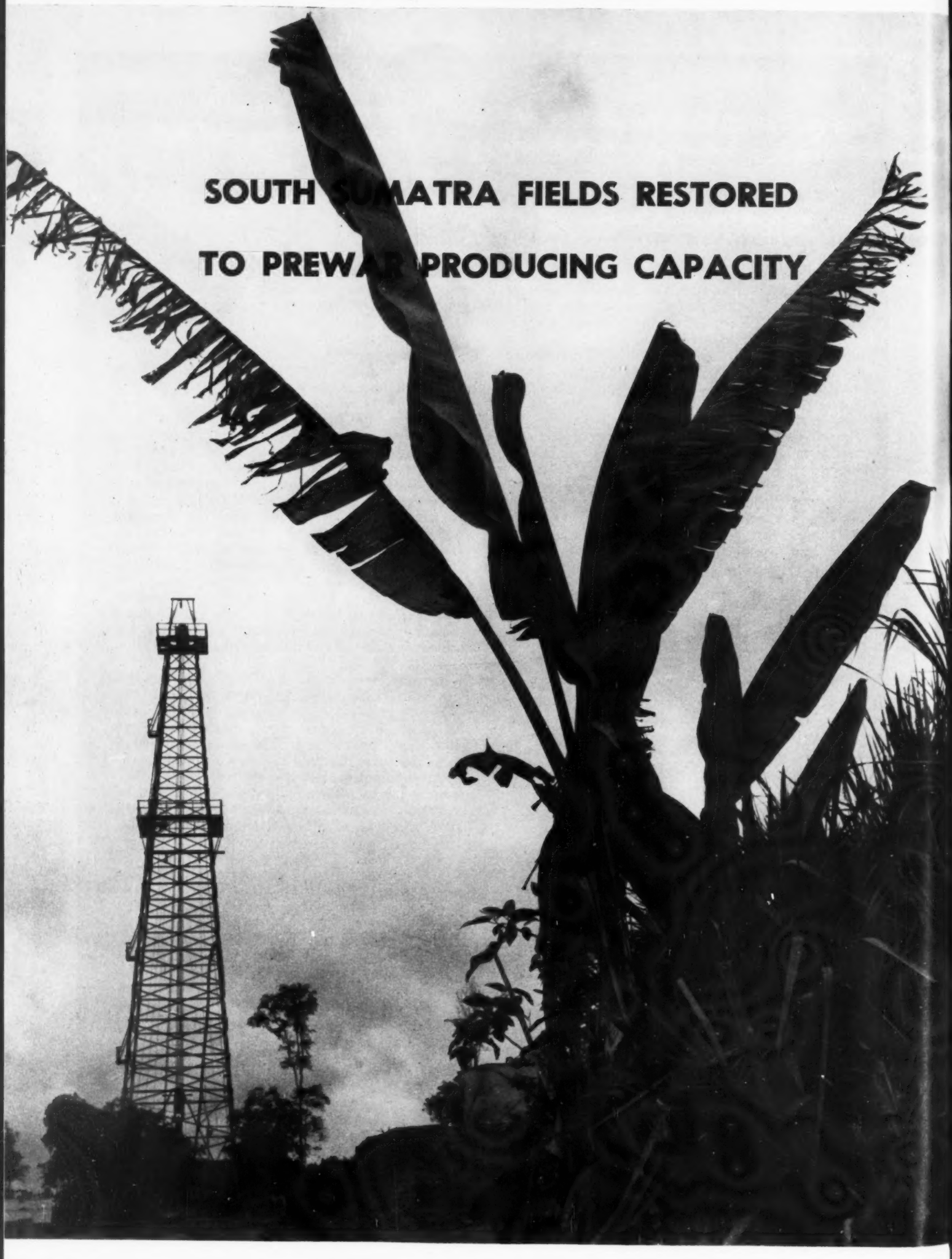
Actually the underlying cause for the rash of oil inquiries was a widespread feeling of concern among consumers over the possibility that a shortage of certain products might develop. The difficulty of obtaining steel for all operations and particularly for providing sufficient transportation for crude and products had been widely discussed. In certain districts oil companies had found it necessary to allocate motor fuel to local distributors for comparatively brief periods. The petroleum industry itself was urging delay in the installation of oil heating units because of possible inability to meet all demands.

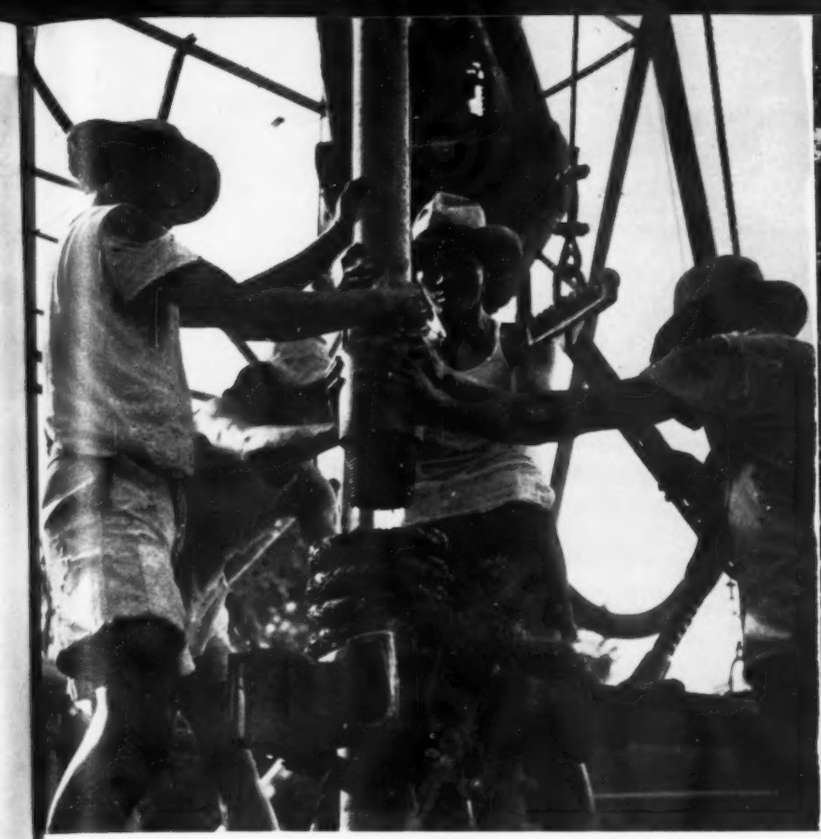
To the average American no prospect, except possibly actual deprivation of food, is more disconcerting than the mere thought of being without gasoline for his car or fuel oil for his home furnace. Consequently Congress began to hear from its constituents and Congressmen, ever responsive to that type of appeal, moved into action.

Had the national election been held in November 1947 instead of 1948, it is possible that government regulation of the oil industry might have been an issue in certain parts of the country or even that the display of sentiment favoring such action might have led to new legislative proposals. But in the months that intervened two important results have taken place. By concentrated, all-out effort the industry has put production on a new and stable high level, has expanded refining, transportation and storage facilities and has established a reasonable assurance against any serious shortage of products. At the same time by patiently answering the questions of official probers, presenting facts and refuting fallacies, the members of the industry have done a valuable educational work with the result that most of the investigating committees, including those that started out with a hostile attitude, have reached the conclusion that the oil industry has performed a great service under difficult conditions.

In the report submitted last month to the American Petroleum Institute on the long-term availability of petroleum by the committee of which L. F. McCollum is chairman, it was shown that petroleum liquids will be available in increased quantities as the years pass and that domestic production can be supplemented as needed by imports and by synthetic products from natural gas, coal and shales. The committee calculated that by 1953 production outside the United States will reach five million barrels daily or double its present volume, thus relieving the American industry of the need of exporting vast quantities of petroleum products as it has had to do in the past.

Certain points emerge from a consideration of the oil industry's course in 1948. One is that the best answer to attacks is, as has been many times pointed out in these pages, the industry's own shining record of achievement in meeting emergencies. As a corollary, let it be assumed that this record is made known by full publicity, probably with special emphasis in the coming months on the necessity for good profits to pay the increasing cost of new developments and plants. Nothing in the record shows that the American people look with favor upon government control of industry or that they will do so unless they can be convinced that it is the only alternative to national disaster. A special accolade should go to the oil industry of 1948 in adding to the public estimation of its competence and outstanding service.


SOUTH SUMATRA FIELDS RESTORED
TO PREWAR PRODUCING CAPACITY



Standard Vacuum has found that its Indonesian employees have good mechanical aptitudes and do excellent work at refineries and in the oil fields. Drilling was undertaken by Indonesian crews without full safety equipment because of the urgent need for oil in Oceania.

Indonesian punch core crew at work in the Sumatran jungle near Standard-Vacuum operations in the Pendopo field. Geological and geophysical reconnaisance work has been resumed on company properties since the war and some wildcatting is being done to supplement rehabilitation

IN a year of intensive rehabilitation work Standard-Vacuum Petroleum Maatschappij (SVPM) has rebuilt crude production of its three major fields in South Sumatra to slightly above prewar levels and is resuming active exploration work so that future production may be maintained. The 81-mile pipeline from producing fields to the Soengei Gerong refinery has been repaired and put into operation, and reconstruction of the refinery itself has been completed to prewar capacity.

While much yet remains to be done to put the war-damaged properties into satisfactory operating condition, SVPM in 1949 will be able to contribute somewhat more petroleum to the needs of the Far East than it did in 1939. Before the end of 1949 the company will have spent more than $100 million in reconstruction since VJ-Day. This is no small contribution to the economy of the Orient when it is remembered that the Far East never has been self-sufficient in its supply of oil. Before the war Oceania and East Asia required about 100,000 barrels of oil daily from other parts of the world. Much of this came from California which now cannot afford to make substantial offshore shipments due to the decline in production in that state and to the great increase in population and oil demand on the Pacific seaboard during the last decade. Current demand in the Far East is 25-35 percent larger than prewar, while production there is only about 75 percent as great. The deficit currently is being made up from the Middle East, draining off some of the oil from that area so urgently required for the reconstruction of Europe.

SVPM was able to gain access to its three fields in south Sumatra in August, 1947, whereas several other SVPM fields in Indonesia still are not being produced. Until political unrest is allayed, it is unlikely that all of the producing properties in central and northern Sumatra and in Java will be restored to the prewar operators.

At the time of the Japanese invasion of south Sumatra, SVPM was operating 264 wells in the Talang Akar-Pendopo field, 115 wells in Djirak, and 140 wells in the Benakat field. Radja had been discovered as the result of a 7,000-foot wildcat but was not being produced. Total wells capable of producing in the four areas was thus 520. Output was about 45,000 barrels daily.

Dutch military authorities succeeded in destroying a substantial number of wells before the Japanese took over. Some wells were cemented in, some were made inoperable by other methods. The invaders restored a limited number of wells in SVPM's fields. Within three months after SVPM engineers were able to enter the field in August, 1947, some 100 wells had been placed in production, and by the end of the year production for the area was averaging 20,000 barrels daily. From that time onward progress in reconditioning has been steady and production has more than doubled. Production in October, 1948, averaged 50,400 barrels daily. Production from SVPM's south Sumatra fields in January, 1948, averaged 24,000 barrels daily, and for the next six months, May through October, averaged 47,200 barrels. It is expected that the average production for the year 1948 will approximate 43,000 barrels daily.

←

Heavy rig drilling in the Pendopo area. All photographs with this article are by Corsini for Standard-Vacuum Oil Co.

Agile Indonesians make exceptionally good rig builders.

Recently a shortage of water hampered field operations in South Sumatra fields, but usually it is just the opposite. Exceedingly heavy tropical rains make it difficult to keep automotive equipment in motion.

Operators in Indonesia have been fortunate in re-employing a large number of Indonesians with prewar oil field experience and training. Many Indonesians remained in the vicinity of the properties during the war, living off the land as best they could. Some lived in company houses throughout the Japanese occupation, while others drifted into distant parts of the island. When the territory was reopened, prewar employees were eager to resume their old jobs. Some of those in Republican areas made their way back to the refinery and field camps. Indonesians have good mechanical aptitudes and are competent operators of mechanical equipment, making excellent oil field and refinery employees.

When SVPM regained control of its properties, they found the former employees very short of food and clothing. Trade was at a standstill and currencies were of doubtful value, so it was almost impossible to buy goods. The company imported rice, edible oils, tea, condiments, tobacco, cloth and other wanted materials and paid employees partly in these items.

Supplies of cloth are better than a year ago, but basic indigenous foods are still scarce and expensive in the open market, although this situation, too, is steadily improving. To meet the situation, SVPM is selling employees rations of basic food stuffs in quantities based on numbers of persons in the family at subsidized prices. In addition the company operates commissaries where generally-wanted items may be purchased at reasonable prices.

Housing has been very short since the company regained its properties. Much of the prewar housing was unavailable or in bad shape, and rehabilitation materials have been scarce. Housing construction is now considered by the company management to be of equal importance with field and refinery work.

In the Talang Akar-Pendopo field 226 wells have been placed on production so far this year. This compares with 152 on January 1, 1948, and 264 prewar. Five drilling rigs and one repair rig are working in this field. In Talang Akar-Pendopo the production horizon is Tertiary sand found at about 2,800 feet. Drilling is not difficult, so a well can be completed and put on production in about a month's time. Experience has shown that, in some instances, it has been more economical to drill a new well than to try to recondition a well damaged by the military. At the end of October, 1948, the five drilling rigs had drilled 36 new wells, and the one repair rig had restored 38 of the wells to production. By January 1 the Talang Akar-Pendopo field will have produced around 130 million barrels since its discovery in 1922. Although they neglected the equipment itself, the Japanese did follow closely the producing methods established by SVPM. As a result the reservoir was not impaired and production is still recovered by natural flow.

The number of wells placed on production in the Benakat field has been doubled this year. Latest reports show 75 wells producing compared with 38 on January 1, 1940, and 140 wells prewar. Recently operations have been hampered in this field by lack of water, due to the unusually dry weather and the delay in rehabilitating the prewar water system. In spite of this, one repair rig has rehabilitated 37 wells, thereby increasing production from 3,000 barrels at the beginning of the year to around 8,000 barrels daily at present. Prewar production was about 10,000 barrels daily. Cumulative production is 40 million barrels since the field was discovered in 1933 in Tertiary sand at about 1,500 feet. Production is still being obtained by natural flow except for a few wells being produced by gas lift. No new wells were drilled this year.

There were 115 wells in the main Djirak field before the war, producing about 6,000 barrels of 38 gravity oil from Tertiary sand found at about 1,000 feet. At the beginning of this year only nine wells were on production with a total output of 136 barrels daily. Since then 51 more wells have been reconditioned, and production has risen to 4,500 barrels daily. Cumulative production of the field since discovery in 1930 is about 23 million barrels.

Deepest production developed by SVPM in south Sumatra is at Radja where a discovery had been made at about 7,000 feet in 1941 shortly before the Japanese invasion. The well had not been brought in as a commercial producer, and no pipeline outlet had been provided, so it stood idle throughout the war. Since the war four more wells have been drilled to depths ranging from 7,000 to 9,000 feet. There now are three strings of tools running in this field, and an eight-mile pipeline is being laid to connect with the main company line to Soengei Gerong. This is an eight-inch line and will be ready for regular deliveries early in 1949.

The Radja discovery was drilled on a gravity maximum, and not much is known about the structure as yet. The production comes from Tertiary sands similar to those found in other south Sumatra fields. Oil produced from this field tests 36.6 gravity and is similar in character to that produced from adjacent fields. The crude has a large wax content and is a high-pour-test oil. To date this field has been operated from temporary camp and industrial facilities installed shortly before the war and since VJ-Day. The company is now developing plans which contem-

Above: Housing under construction for senior Indonesian employees in SVPM's Pendopo field. Materials for housing were imported from Singapore. Above at right is a view of temporary cooking quarters erected for use by Indonesian employees pending completion of permanent housing. Building of houses has been an important part of the field and refinery rehabilitation work during the past year.

Indonesian cooks attached to geological party operating from a jungle base camp in Sumatra.

plate the permanent camp and other oil field installations required for the operation of a producing field, including main lease roads, permanent staff and workers' residences and material-handling facilities.

Exploration work has been in progress in Sumatra since 1885, and a majority of the structures discoverable through surface geology have been tested. SVPM began its search for oil in south Sumatra in 1912 and spent ten years and a great deal of money before discovering its first big field—Talang Akar-Pendopo—in 1922. There is still a large area in the wide, swampy plains which is considered favorable for oil accumulation. Much of the terrain is similar to that of south Louisiana, which makes the going rough on the geologists and geophysicists.

In the first year since producing and pipeline operations have been resumed, SVPM has been able to supply oil to the Soengei Gerong refinery as rapidly as the refinery could process it. While the company has much development work to do on its Radja discovery and on the restoration of its prewar fields, it also must discover new sources of crude oil in order to maintain present production rates and so ensure a steady supply of oil for the Orient and Oceania.

Members of SVPM geological punch-core crew examine maps at jungle base camp. Obviously it was hot when this photograph was snapped by Mr. Corsini.

FUTURE OF MIDDLE EAST DEVELOPMENT CLARIFIED BY RED LINE SETTLEMENT

Drilling well in the Abqaiq field.

THE future of oil development in the Middle East has been clarified considerably within the past thirty days as a result of the conclusion of several separate negotiations among various interests some of which has been in progress about two years. Of major importance is the liberalization of the Red Line Agreement in 1928 permitting Standard Oil Co. (New Jersey) and Socony-Vacuum Oil Co. Inc., to purchase stock interests in Arabian-American Oil Co. A few weeks previously Arabian-American renounced its concessionary privileges in the neutral zone between Kuwait and Saudi Arabia, thus opening the door to exploration in that area by other oil companies. Also Arabian-American claims were upheld that its concession in Saudi Arabia extends to submerged coastal lands within the jurisdiction of that country.

Immediate effect of the red line settlement will be the transfer in December of a 30% stock interest in Arabian American and Trans-Arabian Pipe Line Co. to Jersey Standard and a 10 percent interest to Socony-Vacuum. The stock sale will liquidate a loan to the Arabian-American of $76,500,000 guaranteed by Jersey and a loan of $25,000,000 guaranteed by Socony and will provide additional capital for proposed developments. It will reduce Standard Oil Co., of California and The Texas Co., participation to 30 percent each. Total sale price of the 40 percent stock interest now to be transferred has been reported at about $150 million.

Coincident with settlement of the Red Line controversy, W. F. Moore, president of Aramco, and B. E. Hull, president of Tapline, announced that these two companies are planning capital expenditures in Saudi Arabia totaling $520 million before the end of 1953. This is approximately a third of the $1,500 million which oil companies plan to invest in the Middle East within the next five years.

Announcement by the Jersey company of the settlement with Iraq Petroleum Co. stockholders reveals further expansion of that company's operations beyond those which had been reported previously. Jersey Standard stated that Iraq Petroleum intends to build an additional 30-inch pipeline from Kirkuk to the eastern Mediterranean. This will at least double the prospective outlet for IPC as compared with previous plans. British, French and other stockholders will thus be assured of a market for as much oil as can be produced efficiently and delivered to the seaboard without fear that Saudi Arabia will grab the lion's share of the market. It also will assure European countries of adeuate supplies of oil to replace exports from the Americas which are likely to decline in future years.

Under the previous agreement among IPC stockholders each was entitled to crude oil from company properties in proportion to its stock interest which is as follows:

Company*	Percent
Anglo-Iranian Oil Co.	23.75
Compagnie Francaise des Petroles	23.75
Royal Dutch-Shell	23.75
Near East Development Co.	23.75
Participations & Investments Ltd.	5.00

* Anglo-Iranian interest is through D'Arcy Exploration Co., Ltd., and Royal Dutch-Shell through Anglo-Saxon Petroleum Co., Ltd. Near East Development is owned by Standard Oil Co. (N. J.) and Socony-Vacuum Oil Co., Inc. Participations & Investments is owned by C. S. Gulbenkian who was largely instrumental in obtaining the original concessions through his holdings in the National Bank of Turkey.

Under the new settlement each shareholder in IPC may obtain crude oil on equitable terms from the company based on its stated requirements rather than its stock interest as heretofore. Since Mr. Gulbenkian has no refining or marketing facilities, the new agreement provides that his share of the oil to be produced may be purchased by the other partners at its fair value. In its statement dealing with this phase of the settlement, Socony-Vacuum said that "Problems pertaining to currency payments, which have arisen out of exchange controls recently instituted in so many countries, have also been settled harmoniously." Press reports have suggested that Mr. Gulbenkian was guaranteed dollar payments for his share of the Iraq oil, but this detail has not been announced by any of the stockholders.

Negotiations by Jersey Standard and Socony-Vacuum with Anglo-Iraniam Oil Co. (one of the IPC stockholders) before the current settlement was reached, resulted in an agreement under which the two American companies undertook to purchase large quantities of oil from Iran over a period of twenty years. This phase of the various negotiations was primarily responsible for organization of the Middle East Pipe Line Co. by Anglo-Iranian, Jersey and Socony. Middle East will construct a 34-inch line from Abadan to the Mediterranean to carry Iranian oil to European markets. This project alone will cost in the neighborhood of $200 million. It will largely increase the outlet from oil fields of southwest Iran, where Anglo-Iranian has been a producer of oil for 40 years and a concession owner since 1901.

Any very large increase in the production of either Iran or Iraq must await either an improvement in political conditions in Palestine or an increase in tanker facilities or both. This year Anglo-Iranian will increase its production about 15 million barrels over 1947, and this is entirely attributable to an enlarged tanker fleet. In the first half of the year Iranian production averaged 483,000 barrels daily compared with 410,000 barrels daily in the first half of 1947. September production had risen to 560,000 barrels daily, and the average for the first nine months of the year rose to 500,000 barrels per day. Present outlook is that 1949 production may rise another eight million barrels over this year.

The proposed 34-inch line from Abadan to the Mediterranean will not, of course, be ready to operate for several years because of the back of steel. As is the case with other major areas in the Middle East, there is no question about the ability of the Iranian fields to produce much greater quantities of oil than they are producing today. Estimated Iranian reserves as of Jan. 1, 1947 were 8.9 billion barrels. Seven fields have been found in Iran, and of these six are being produced. The Lali field is shut in due to lack of pipeline facilities.

In Iraq it has not been possible to keep production up to even the 1947 level this year. This is due entirely to the disturbed political conditions in Palestine, however. Late in the spring it was found necessary to close the 12-inch line from

C. S. Gulbenkian (Wide World photo)

the Kirkuk field to Haifa and to shut down the Consolidated refinery at Haifa. The second 12-inch line with a terminus at Tripoli has been kept continuously in operation and has delivered about 45,000 barrels of oil to the coast daily. In recent years the two lines have been operating at about 92,000 barrels daily, and this has been the production of the Kirkuk field.

Immediate pipeline construction projects of IPC are two additional 16-inch lines to the coast, each with a capacity of about 90,000 barrels daily. One of these is to be laid to Haifa and the other to Tripoli. The Haifa line was to have been completed and ready for operation in January 1949, but the completion date now is uncertain due to a combination of slow deliveries of pipe and the political situation. The line is well over 50 percent completed now, however. No actual pipe has been laid on the companion line to Tripoli, although about 25 percent of the pipe is on the ground.

The Iraqi government currently is asking for a revision of the three concessions in four particulars. Iraq wants the oil companies to pay royalties in gold at the free market rate, to increase production, increase the number of Iraqi employees of IPC and to give preference to Iraqis up to 20 percent on any future issue of IPC stock. In this connection it should be noted that the present stoppage of crude deliveries through the Kirkuk-Haifa line is by Iraq government order. This stoppage has reduced Iraq production by 50 percent for nearly six months.

Latest pipeline proposal for an added outlet for Kirkuk crude is a 30-inch line to the Mediterranean. It is presumed that this line would have a capacity of over 230,000 barrels daily and thus would bring the outlet for the field up to some 600,000 barrels daily. At the end of 1947 there were 31 producing wells in the Kirkuk fields and 48 observation wells. Production then was about 92,000 barrels daily. Known reserves of fields in Iraq, most of which are in the Kirkuk field, were estimated at six billion barrels on Jan. 1, 1947. Kirkuk alone is capable of keeping the present and proposed pipelines operating for many years to come.

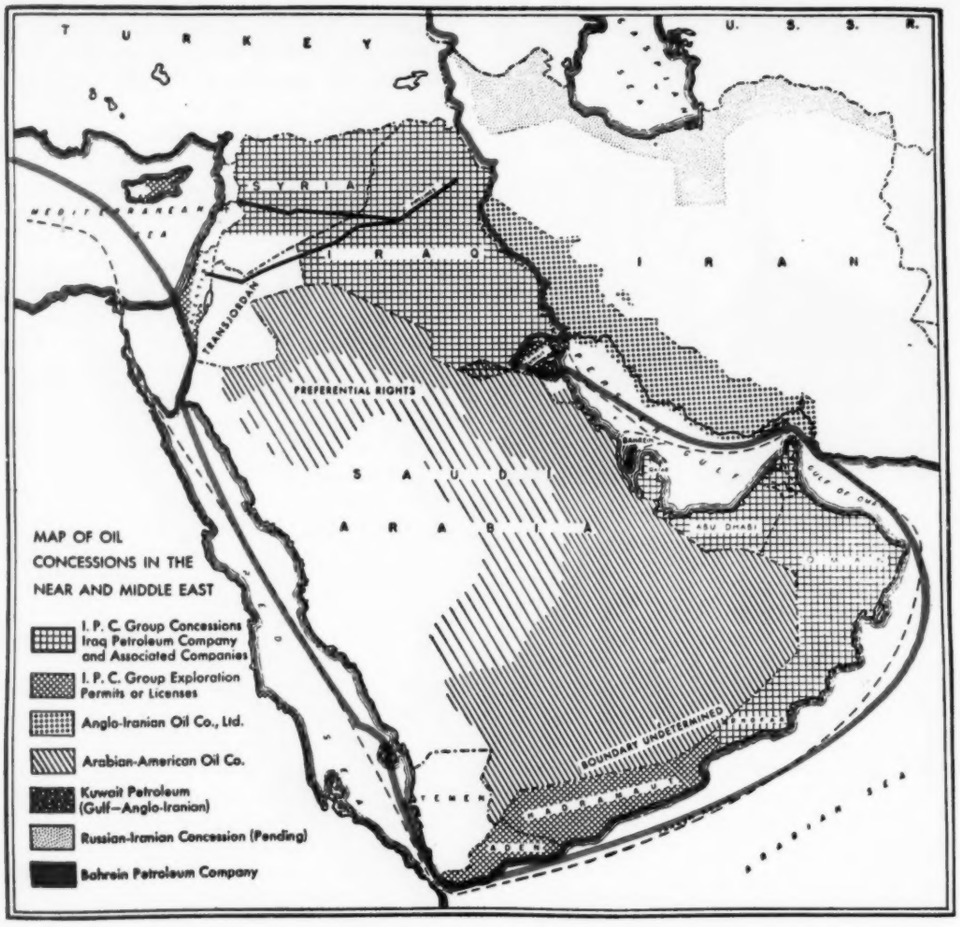
There are three separate concessions covering various parts of Iraq, all owned by IPC stockholders, but each has a different termination date ranging from March 14, 2000, to November 30, 2015. The first concession was granted by Turkey to British and German interests before World War I. After this war the Kingdom of Iraq was formed, and France was given a mandate over Syria. At a result France was given the prewar German interest in Turkish Petroleum Co. The United States also demanded a part in the development of the State Department's "open door" policy. Final result of the prolonged negotiations was the awarding of a 23.75 percent interest to American companies making up the Near East Development Co. Originally five American companies were included, but these were reduced by resignation or purchase to the present two. Drilling in Iraq by IPC was begun in April 1927, and the 60,000-barrel Baba Gurgur discovery drilled in in October.

In 1928 the famous Red Line Agreement was signed by the various companies comprising IPC. This agreement was actually a modification of a 1914 British Foreign Office agreement which provided that the then British and German signatories would not act independently "directly or indirectly in the production or manufacture of crude oil" within most of the area of the old Ottoman Empire. The term, "Red Line Agreement," took its name from the fact that a red line was drawn on a map circling the old Ottoman Empire as it existed in 1914 just prior to the outbreak of World War I. After the war the original Turkish Petroleum Co. partners wanted these restrictions carried forward to the new American and French partners, and as a result the new Red Line Agreement was signed, restricting individual company action in the area indicated on the accompanying map. This agreement was approved by the U. S. government.

There was no trouble about the agreement until after the close of World War II, when Arabian American Oil Co. partners began to see the magnitude of the properties they had obtained and to realize that they needed help in the development of Saudi Arabia, both from the standpoint of financing and from the standpoint of market outlets for oil. Aramco invited Jersey and Socony-Vacuum to participate because of their fully-developed marketing facilities throughout Europe, Asia and Oceania.

Before the invitation to participate in Aramco Jersey and Socony legal advisers had advanced the opinion that the Red Line Agreement was no longer in force, but shortly after announcement of the proposed stock purchase, the French partners in IPC filed suit in British courts to enforce the old agreement. It was found possible to satisfy the French interests early in the course of negotiations by assuring them of adequate crude supplies. Mr. Gulbenkian was somewhat harder to reach an agreement with, and it was not until early in November that all details of the settlement with him were worked out.

Not much was thought of the possibilities of de-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MAP OF OIL CONCESSIONS IN THE NEAR AND MIDDLE EAST
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I. P. C. Group Exploration Permits or Licenses
Anglo-Iranian Oil Co., Ltd.
Arabian-American Oil Co.
Kuwait Petroleum (Gulf—Anglo-Iranian)
Russian-Iranian Concession (Pending)
Bahrein Petroleum Company

Map showing the area enclosed by the "Red Line" of 1928.

veloping oil production in Saudi Arabia until after Standard of California and Texaco began operations on Bahrein Island in the Persian Gulf in 1930. After discovery of oil in 1933, a concession was negotiated by the two companies covering some 400,000 square miles of Saudi Arabia on the theory that formations producing oil on Bahrein Island might very well be found across the narrow strait on the Arabian mainland.

First geologists for Arabian-American began reconnaissance work in the fall of 1933. Fourteen months later drilling was begun on the Damman structure which seemed much like the one on Bahrein. The drill didn't find it so, however. At the end of 1937, after spending $3 million on ten wildcat wells, no commercial production of moment had been found. Finally a deep test was drilled in during March 1938, and the prolific Damman field discovered. More than another year of work was required before the first cargo of oil was loaded out in May 1939. Total investment in wells, pipelines and other facilities ran to some $37 million before the concession became a commercial venture.

In 1940 two additional fields were discovered, the great Abqaiq structure and Abu Hadriya. A small refinery was constructed at Ras Tanura. The Qatif field was discovered in 1945, and this year a well at Ain Dhar about 27 miles west of Abqaiq found a 250-foot section of oil sand similar in character to that in Abqaiq which company engineers believe has added substantially to the previously proven reserves. On Jan. 1, 1948, it was calculated that known reserves in Saudi Arabia totaled about seven billion barrels. The area embraced by the vast concession is as great as that of the combined states of Oklahoma, Texas, Louisiana and Arkansas, and a very large part has not been explored, so there may be important additions to known reserves in future years. Aramco still have 50-odd years in which to develop the property. Its primary concession expires in 1999, and a supplementary concession expires in 2005.

Production from the three operating fields in Saudi Arabia recently passed 500,000 barrels daily for a short period, but it has been necessary to reduce the output of wells in recent weeks because of a curtailment of refinery operations at Ras Tanura to provide for inspection and repair. The Ras Tanura refinery originally was designed to process 50,000 barrels per day, but it has actually been running about 135,000 barrels daily in order to supply fuel requirements of the United States Navy and demands of consumers in the Orient and Oceania.

During the first ten months of 1948 production in Saudi Arabia averaged 373,579 barrels per day. October production was at the rate of 468,727 barrels daily. For the year as a whole production will be about 380,000 barrels per day compared with 246,169 barrels daily in 1947, an increase of 55 percent. After completion of the 1,100-mile Tapline across the desert to the Mediterranean, it is anticipated that Aramco production can be increased to about 700,000 barrels daily. The 30-31-inch pipeline will have a capacity of about 300,000 barrels daily when first completed and later will carry 500,000 barrels daily when additional pumping capacity is installed.

Thus far 145 miles of line have been laid, and about 100 miles of additional pipe is on hand. Construction is proceeding at the rate of about five miles weekly. Expenditure to date of the line is about $70 million. Officials of the company anticipate that additional quantities of pipe will be licensed for export in the near future. Tapline released one three-month supply of pipe to a gas pipeline company in the United States to help prepare for this winter's domestic heating load.

Aramco has been successful in obtaining an export quota on steel, despite the scarcity, because it has been shown that oil supplies for European recovery must come from the Middle East and because the Trans-Arabian pipeline will require much less steel than would the 102 T-2 type tankers which would be necessary to transport the same quantity of oil on the 7,200-mile trip around Arabia and through the Suez Canal. It is calculated that the pipeline will require 365,000 tons of steel and the 102 ships 565,400 tons of steel. It has been said, also, that capacity of the Suez Canal would be overtaxed by the proposed oil movement.

Operations of Aramco have brought new prosperity to Saudia Arabia where life for the Arabs has been a difficult struggle against desert conditions for thousands of years. The company employs more than 15,000 Saudi Arabs and has a local payroll of about $18 million per year. Royalty payments to the government will exceed $29 million this year and will increase in years to come.

The company has done much to improve housing, education and recreation facilities for the people. It is assisting the government in agricultural development through irrigation and guidance by agricultural experts.

SAUDI ARABIA

PRODUCTION BY YEARS

(Barrels)

Year	Daily Average	Total
1939	10,778	3,933,90
1940	13,865	5,074,83
1941	11,809	4,310,11
1942	12,412	4,530,49
1943	13,337	4,868,18
1944	21,296	7,794,42
1945	58,386	21,310,99
1946	164,229	59,943,76
1947	246,169	89,851,64
1948 Est.	380,000	138,000,000

CATALYTIC PROCESSING OF SOUR GAS OIL

By William M. Carney, Henry D. Noll and A. Wesley Hoge*

THE volume of high sulfur crude oils refined in this country has been increasing rapidly over the past several years. Vast quantities of Venezuelan and Near Eastern crudes are imported at present, and the predictions are that over one million barrels per day of the latter crudes will be processed in this country within the next few years. These foreign crudes are characterized by high sulfur content, and in this and other respects are quite similar to the Arkansas crudes produced and refined by the Lion Oil Company at El Dorado, Arkansas. Table I gives inspections of the crude processed by Lion as well as inspections of typical Near Eastern and Venezuelan crudes.

TABLE I

Crude	Oficina (Venez.)	Bahrein	Iraq	Lion (Schuler)
Gravity—°API	31.1	32.7	35.5	34.5
TBP Dist., °F				
IBP	83	—	—	86
5%	160	112	128	145
10%	220	186	197	210
20%	318	305	295	300
30%	396	402	380	395
40%	490	501	465	485
50%	563	600	547	595
60%	658	700	620	695
70%	791	806	723	785
80%	911	71.2% @830	78.4% @830	—
Sulfur-Wt. %	0.81	2.04	1.92	1.40
Conradson Carbon-Wt. %	—	7.75	3.6	3.1

The refinery operations at El Dorado are integrated about the operation of a 5,400 barrel per day TCC unit. After the recovery of certain straight run products from the crudes by conventional means, there is available heavy gas oil and reduced crude for charging stock to the TCC plant. Although the average sulfur content of the reactor charging stock derived from this mixture is about 1.7 weight percent, such material has been processed successfully in the TCC unit since September, 1947. A typical inspection of the charge to the Lion TCC reactor is given in Table II along with inspections of gas oils of similar range derived from Near Eastern and Venezuelan crudes.

TABLE II

Gas Oil	Oficina (Venez.)	Bahrein	Iraq	Lion TCC Charge
Yield-Vol. % of Crd.	30.0	35.0	32.0	30.0
Gravity—°API	24.5	23.0	24.3	25.7
Vac. Dist. °F.				
IBP	550	550	570	484
10%	615	620	626	620
20%	655	660	670	670
30%	695	695	705	715
40%	735	725	740	750
50%	775	760	775	785
60%	820	795	815	825
70%	860	850	850	865
80%	890			910
Aniline Pt., °F.	175	175	190	165
Sulfur, Wt. %	0.90	2.85	3.1	1.7

* Lion Oil Company.

A wide variety of operating conditions have been imposed upon the TCC unit in order to arrive at optimum product distribution in the overall refinery balance of products. Fresh feed throughput, recycle ratio and temperature have been the variables most widely studied. After considerable exploration of the effect of these variables, it was concluded that with the feed stocks available a low temperature operation with a nominal amount of internal recycling was most desirable at El Dorado. This type of operation gives an exceptionally high combined yield of 10# RVP motor gasoline and 600°F end point distillate fuel oil of about 70 volume percent. The gasoline yield is further augmented to the extent of approximately 8.0 volume percent of virgin reactor charge by polymerization of the unsaturated portions of the C_3 and C_4 fractions. Typical TCC operating conditions and yields are given in Table III.

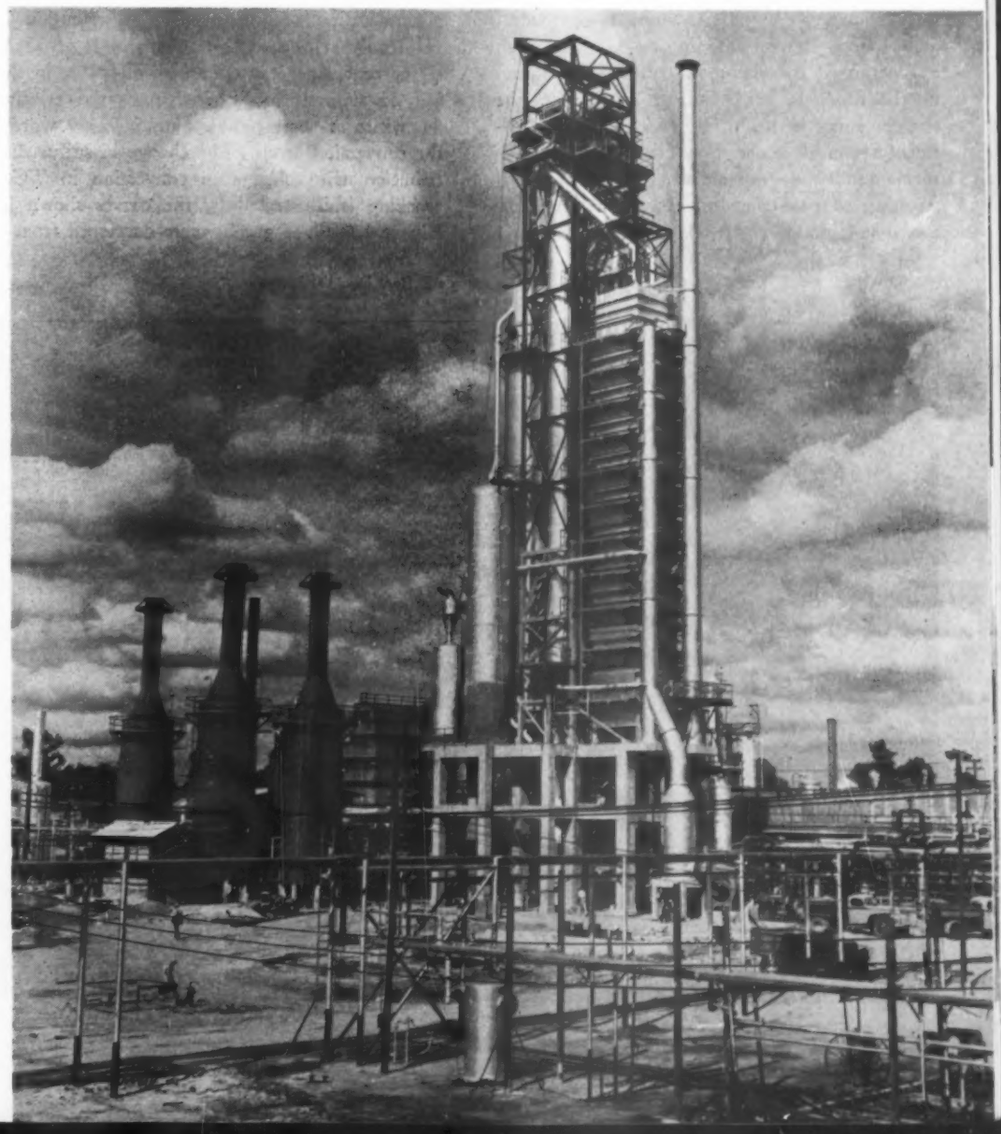
TABLE III

Charge Data	BPSD
Virgin Charge to Tar Sep.	5838
Recycle " " " "	908
Total Tar Sep. Charge	6746
Tar Separator Bottoms	1183
Total Reactor Charge	5563
Virgin Reactor Charge	4655
Operating Conditions	
Space Velocity (Total Charge), V/Hr./V	1.0
Catalyst/Oil Ratio (Total Charge). V/V	2.4
Top Reactor Pressure, PSIG	8.0
Oil Vapor to Reactor, °F	860
Catalyst to Reactor, °F	1005
Catalyst Circulation Rate, Tons/Hr.	72

Product Yields	BPSD	Lbs. Hr.	Vol. % Virgin Reactor Chg.	Wt. % Virgin Reactor Chg.
10# RVP, 410°F. E. P. Motor Gasoline	2376		51.0	
#2 Fuel Oil	855		18.4	
Heavy Catalytic Gas Oil	855		18.4	
Excess C_4's	602		12.9	
C_4 Plus Liquid Recovery			100.7	
C_3 & Lighter Gas		4390		7.2
Coke		2765		4.5

Tests on the products show that despite the low temperature operation, low sulfur content to the gasoline from a high sulfur charge is achieved. For example, after caustic treating in a regenera-

TCC Unit at Lion Oil Co. Refinery, El Dorado, Ark.



tive system, the stabilized TCC gasoline has an average total sulfur content of about 0.10 weight percent and is doctor sweet. The stability of both the catalytic gasoline and No. 2 fuel meets all marketing specifications. Inspections of the various TCC product streams after gas recovery and stabilization are shown in Table IV. As indicated, the end point and the pour point of the No. 2 fuel oil produced are approximately 600°F and 0°F respectively.

TABLE IV

	Stabilized Gasoline	#2 Fuel Oil	Heavy Catalytic Gas Oil
Gravity—°API	59.3	26.0	16.1
ASTM Dist. °F			
IBP	90	448	613
50%	202	520	702
90%	374	571	760+
EP	408	600	
RVP	7.3		
Octanes			
M. M. Clear	80.5		
+ 3cc TEL	86.3		
Res. Clear	92.0		
+ 3cc TEL	97.2		
Sulfur—Wt. %	0.10	1.45	
Pour °F		0	75
Aniline Pt. °F		116	

With the current trend in processing stocks of increasing sulfur content in catalytic cracking units in this country, it is of interest to study the distribution of sulfur in the products from such operations. With this in mind, sulfur balances for the Lion operations have been made. Typical of the results are the data presented in Table V. Also included in Table V are typical sulfur balances for TCC operations on moderately sour and sweet charging stocks. Although a generalized correlation of sulfur distribution in the products versus sulfur content of the charge cannot be made for stocks of widely different chemical composition (the aromatic California crudes are notable exceptions), it is interesting to note that for most paraffinic and mixed-base stocks, about 55 percent of the total pounds of sulfur in the charge appears in the gas and coke products, about 42 percent appears in the cycle stock and about three percent in the catalytic gasoline.

TABLE V

Sulfur Distribution In TCC Cracking

LION GAS OIL

	Lbs./Hr.	Wt. % Sulfur	Lbs./Hr. Sulfur	Wt. % of Total Sulfur
Reactor charge	65,800	1.70	1,118	100.0
Products				
Gasoline	27,600	0.14	39	3.5
Cycle Oil	26,832	1.66	446	40.0
Gas + Coke	11,368		633	56.5
Totals	65,000		1,118	100.0

MICHIGAN GAS OIL

	Lbs./Hr.	Wt. % Sulfur	Lbs./Hr. Sulfur	Wt. % of Total Sulfur
Reactor charge	39,200	0.61	239	100.0
Products				
Gasoline	15,460	0.046	7	2.9
Cycle Oil	15,250	0.55	84	35.1
Gas + Coke	8,490		148	62.0
Totals	39,200		239	100.0

MIDCONTINENT GAS OIL

	Lbs./Hr.	Wt. % Sulfur	Lbs./Hr. Sulfur	Wt. % of Total Sulfur
Reactor charge	129,000	0.14	530	100.0
Products				
Gasoline	41,900	0.049	21	4.0
Cycle Oil	73,100	0.37	270	51.0
Gas + Coke	14,000		239	45.0
Totals	129,000		530	100.0

It should be mentioned that the foregoing generalization regarding sulfur distribution is valid only at normal conversion levels of 55 to 60 percent, since the quantities of sulfur in the individual products depend upon the relative quantities of those products or, in other words, the conversion level. The change in sulfur distribution with change in conversion in TCC cracking is illustrated by the curves shown in Figure 1. These graphs were developed from a large number of TCC runs made on a variety of charging stocks and over a considerable range of operating conditions. The data tabulated in Table V have been plotted on these generalized curves.

Aerial view of Lion Oil Company's El Dorado, Ark., Refinery.

One of the most gratifying experiences in connection with the operation of the Lion TCC unit on sour stocks has been the discovery that a minimum of chemical treatment of the catalytic gasoline is required to produce a non-corrosive, stable, doctor sweet product. It is generally recognized that sour stock operations involve much more elaborate finishing treatment of the products in order to meet marketing specifications. Prior to the installation of the TCC unit at El Dorado, for instance, the thermal gasoline produced from stocks currently being cracked catalytically had an average total sulfur content of 0.15 weight percent after regenerative caustic washing and copper chloride sweetening. The TCC gasoline, however, is given only a regenerative caustic wash and inhibited, after which the total sulfur content averages about 0.10 weight percent and the product is sweet to the doctor test. The untreated TCC gasoline leaving the stabilizer has a total sulfur content of about 0.15 weight percent, about one-third of which is mercaptan sulfur. The mercaptan compounds present, however, are removed almost quantitatively by a strong caustic wash so that the finished product meets the specifications quoted above. The distribution of total sulfur versus boiling range of the Lion TCC gasoline before caustic washing is typified by the data plotted in Figure 2.

The Lion TCC unit consists of the conventional heater, tar separator, reactor-kiln and distillation sections. Among the latest developments incorporated in the design at the time of construction are a single-split-bucket type, hot catalyst elevator for transporting both spent and regenerated catalyst; self-supporting reactor and kiln sections which result in an economy in the steel superstructure required; and a kiln cooling coil manifold arrangement at the first platform in the structure which facilitates operation by permitting all coil changes to be made at this location. As far as the catalytic section is concerned, only the reactor proper has alloy protection against corrosion by the sour charging stocks.

The hot catalyst elevator, kiln air blower and principal feed and product pumps are driven by steam turbines. In the event of a power failure, the TCC unit proceeds in operation very smoothly, and already this foresight in planning has obviated many temporary shutdowns which would otherwise have occurred.

The catalyst used in the Lion TCC unit is the synthetic bead type. The normal catalyst inventory in the unit is about 225 tons, and the initial charge of catalyst had an activity of 42 by the Cat-A method. After the first year of operation the average activity of the system has leveled out at about 31 Cat-A index. The performance of the catalyst in the unit is shown graphically in Figure 3. It should be mentioned that during this entire period of operation no catalyst has been

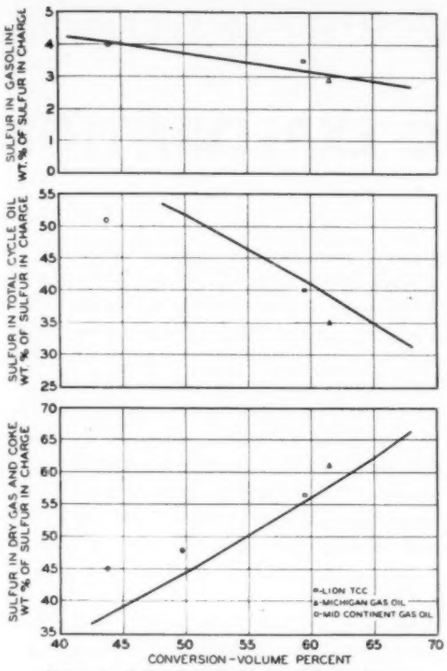

SULFUR IN GASOLINE WT. % OF SULFUR IN CHARGE
SULFUR IN TOTAL CYCLE OIL WT. % OF SULFUR IN CHARGE
SULFUR IN DRY GAS AND COKE WT. % OF SULFUR IN CHARGE
A-LION TCC
B-MICHIGAN GAS OIL
D-MID CONTINENT GAS OIL
CONVERSION - VOLUME PERCENT

Figure 1. Sulfur Distribution in TCC Cracking.

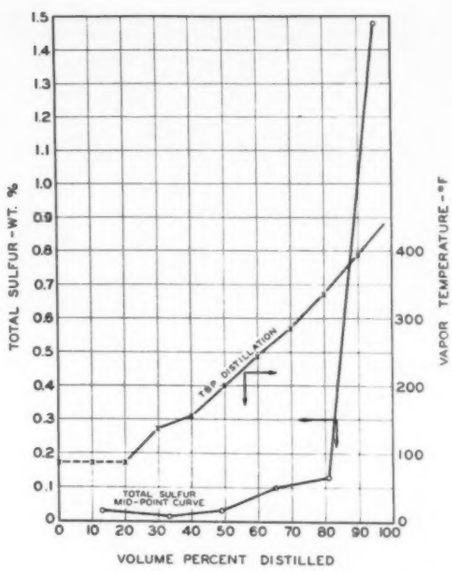


Figure 2. Total Sulfur Distribution Lion TCC Gasoline Before Caustic Washing.

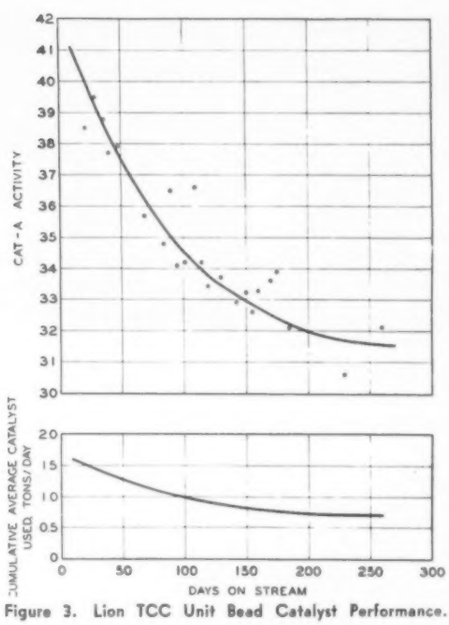


Figure 3. Lion TCC Unit Bead Catalyst Performance.

withdrawn from the unit and replaced with fresh catalyst for the purpose of maintaining average activity. In other words, the only catalyst usage has been that required to replace nominal mechanical losses due to attrition. The actual average usage from September 1947 to the present have been 0.7 tons per day, which is equivalent to about 0.24 pounds per barrel of charge.

The Lion TCC installation is composed of both new and used equipment with alloy steel protection provided only at critical locations. The vapor superheater, tar separator and the entire catalytic cracking section proper were new construction, and the balance of the feed preparation distillation and recovery sections were parts of equipment previously operated in the refinery. Some of the existing equipment which was revamped for TCC service had already been provided with alloy protection for sour stock operation and, as previously mentioned, only the reaction zone of the TCC unit was alloyed. An itemization of the major pieces of equipment and type of alloy employed is given in Table VI.

The unit was shut down on April 4, 1948, for a complete inspection and clean-up after seven months' operation, during which time an on-stream efficiency of 97 percent was realized. That the off-stream time to on-stream time for the turnaround amounted to only seven days is indicative of the excellent condition in which all of the equipment was found. A summarized report of the inspection is presented in Table VII. It is noteworthy that no piping replacements were required because of metal loss from corrosion or erosion despite the fact that, as indicated in Table VI, much of this piping was fabricated of carbon steel. For example, the vapor lines to and from the reactor are carbon steel. Undoubtedly these lines operate at a temperature outside the critical range for corrosion by the Lion stocks. The significance of this experience, however, is that economies in the design of the Lion TCC plant for sour stock operation were realized by providing alloy protection at only critical locations.

At this writing the Lion TCC unit at El Dorado, Arkansas, has been in operation for over one year—September 16—charging sour stocks similar to those derived from Middle Eastern and Venezuelan crudes with gratifying results. With a minimum of alloy protection against corrosion, the unit gives evidence of continued performance equal to that of any other commercial catalytic cracking unit operating on sweet stocks. In addition, a minimum of finishing treatment of the TCC products is required. Therefore, it is concluded that imported sour crudes could be satisfactorily processed without revisions to equipment or processing.

TABLE VI

Item	Material	Existing or Added
Feed Preparation		
Vaporizing heaters	4-6% chrome tubing	Existing
Tar separator	11-13% chrome lining complete	Added
Tar separator bottoms lines	4-6% chrome pipe	Added
Tar separator vapor line & valves	Carbon steel	Added
Vapor superheater	2% chrome tubes	Added
	4-6% chrome heaters	Added
Vapor line to TCC reactor & valves	Carbon steel	Added
Reactor		
Reaction zone	11-13% chrome lining	Added
Reactor internal elements	18-8 stainless	Added
Reactor vapor outlet lines & valves	Carbon steel	Added
Synthetic Crude Tower		
Synthetic crude tower	11-13% chrome lining in lower half—upper half	Existing
	Carbon steel	
Synthetic crude tower piping	Carbon steel	Added
Exchanger	Carbon steel	Existing
Synthetic crude tower overhead condensers	Carbon steel shell	Added
	Admiralty metal tubes	
Overhead receiver & gas sep.	Carbon steel	Existing
Kiln		
Kiln internals	Conventional 4-6% chrome air and flue gas distributors & collectors—2% chrome water tubes	Added

TABLE VII

Item	Condition
Feed Preparation	
Oil charge lines and exchangers	Excellent—no metal loss
Vaporizing heater tubes	Excellent—no metal loss
Tar separator	Alloy lining good except for one broken strip weld
Tar separator bottom lines	Excellent—no metal loss
Tar separator vapor line	Good—no metal loss
Vapor superheater tubes	Good—no metal loss
Vapor line to reactor	Good—no metal loss
Reactor	
Reactor shell	Excellent — alloy lining good except for six broken strip welds
Reactor internals	Excellent—no evidence of erosion or corrosion
Reactor vapor line and valves	Excellent—no evidence of corrosion
Synthetic Crude Tower	
Synthetic crude tower	Tower clean—lining in good condition
Synthetic crude tower piping	Excellent—no evidence of corrosion
Overhead condensers	Good—no fouling or evidence of sulfur attack on admiralty metal or carbon steel
Overhead receiver	Good
Kiln	
Suspended tile lining	Excellent—no erosion or spalling
Air and flue gas distributors	Excellent
Cooling coils	Good—very slight scaling on inside
Catalyst piping	Excellent—no replacement required
Hot Catalyst Elevator	
General Condition	Excellent—indicated chain life 3 years
Traction Rims	0.049" Maximum wear
Chain Links	0.0237" " "
Chain Knuckles	0.078" " "

NEW METHOD OF SEISMIC EXPLORATION

THE Slick Institute of Inventive Research of San Antonio has recently given publicity to a new method of seismic exploration for oil which was invented and reduced to practice by Dr. Thomas C. Poulter, formerly of the Armour Research Foundation and now associate director of Stanford Research Institute.

The Poulter method involves a new application of an old principle of sound and pressure waves in seismic exploration. Heretofore geophysicists in search of geological structures in which oil might be found have depended on "reflection shooting" in which explosives are detonated in holes drilled to various depths below the surface of the ground; the force of the explosion sets up small quake waves in the rock formations of the earth's crust, and from the characters of these waves geophysicists, in collaboration with petroleum geologists, draw conclusions as to the presence or absence of oil reservoirs in the vicinity.

The interesting point of the Poulter method of seismic exploration is that it is not necessary to drill holes in the ground to receive the explosive. Instead, small, specially shaped charges of explosive are set upon stakes relatively close to the ground surface and spread out in a hexagonal pattern of 7, 13 or 19 points, with one in the center, over a selected location. Depending on the type of records sought, comparatively light charges are spaced from five to 85 feet apart and detonated simultaneously.

In all other respects there is no change in the usual practice, except such as result from a simplification of the procedures. No modification of any kind is required in the standard seismic equipment, but since no drilling equipment is required, the procedure of operation is made more flexible, the shooting party can work more closely with or even be combined with the surveying party, and if it is found that additional shot points are desirable, they can be introduced without the necessity of having each of the three groups return to that point.

It has another advantage in that several shots can be made at the same shot point to obtain comparable results without the variation that occurs in successive shots in a hole, or the danger of losing the hole completely and having to have the drillers return to drill another hole to be shot at a later date.

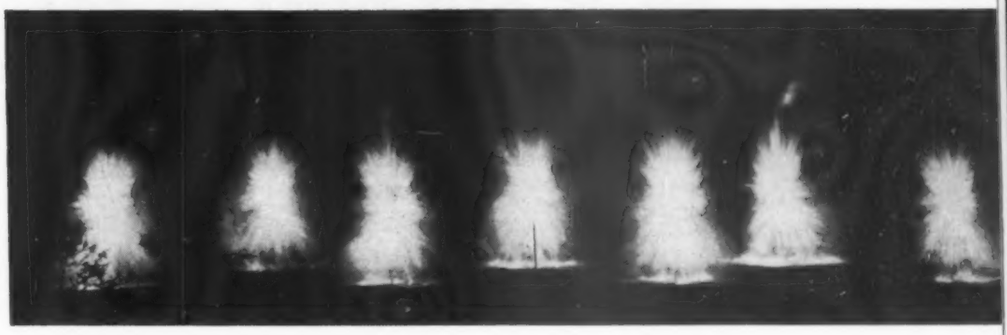
Another advantage is that the Poulter method avoids the risks of the shot hole method as regards damage to nearby structures of concrete or other solid materials; it also avoids the danger of falling stones. Hence it can be employed in areas that are not at present suitable for seismic exploration, and it also may be used over water without danger to marine life.

Besides these, the more important advantages are obvious. The time required for the seismic mapping of a given area is shortened. A big advantage is the saving of the cost of drilling shot holes, which in such areas as west Texas will range from $5,000 to $20,000 per month per party. Finally, in work that has been done in proved and unproved areas in Texas and Oklahoma during the past 15 months, it has been found that the seismic records obtained with the new method are in some cases more precise and convincing than those given by the shot hole method.

The reason why seismic exploration by the Poulter method can be done with small explosive charges on or above the surface, rather than with larger charges buried in deep holes, lies in the difference between the explosion phenomena in the two cases. From studies that have been made of the manner in which the energy of an underground explosion is expended, it was found that as much as 85 percent of the energy may be absorbed within a few feet of the charge; this amount of energy is lost through the work done in crushing the rock or other surrounding material, leaving only a few percent for setting up seismic waves in the rocks. Other studies on the transmission of sound on seismic waves in dry sand of a uniform grain size showed that there is very little absorption if the amplitude or the intensity of the sound is very low. In

Night explosion of 13-charge detonation covering 120-feet area with special shaped charges in hexagonal pattern with one in center.

FOR OIL



Night explosion of seven-charge pattern used in new method of seismic exploration. Explosion covers area of 70 feet with shaped charges placed in a hexagonal pattern.

others words, if the intensity (of the explosion) is very low, 95 percent of the energy may be transmitted, whereas if the intensity is high, as little as five percent or less may be transmitted.

It was further found that, other things being equal, the larger the particle size, the greater may be the intensity before the absorption becomes excessive. But the fact is that in the shot hole method of seismic exploration, the charge is often placed in a weathered layer where the particles are not compacted into a solid mass; in such cases so much of the energy of the explosion will be spent on the weathered layer that there is not enough left to penetrate to the deeper strata and reflect back to the geophones. In developing this method, Dr. Poulter had to find a way of obtaining a sufficiently low amplitude or intensity of the wave motion through the underlying strata. He found that this could be obtained by exploding the charge at the surface of the ground. However, this does not mean that if the intensity at a point on the surface of the ground is reduced sufficiently, good records will be obtained. As this energy travels out from a point, its intensity decreases at a rate which is inversely proportionate to the square of the distance from the source. This is in addition to the absorption phenomena mentioned above. If. however, the wave front is flat instead of spherical, there is no decrease in intensity as a direct result of increasing distance from the source.

One of the most effective ways of minimizing the loss of explosive energy, with an accompanying increase in the efficiency of converting it into a seismic wave motion, is to detonate the charge in an elastic medium such as air and permit the wave motion to travel a sufficient distance in this medium, so that the amplitude or intensity will be diminished to the point where it will transfer to another medium with only a minor loss of energy by absorption. Because the air is so elastic, the total energy in the air wave remains almost constant even after it has traveled for long distances.

By the Poulter method of exploration, charges are detonated at or above the surface of the earth. This sets up an air wave of very high intensity, but since the air is highly elastic even at such high energy levels, very little absorption occurs. This air wave is allowed to travel far enough through the air so that this energy is spread out over an area large enough that the ground will receive and transmit it with a minimum amount of absorption.

Thus the most important sources of loss of energy encountered by the conventional method are removed by the single expedient of detonating a series of properly arranged charges at or above the surface of the earth. By detonating the charges in air, very little energy is absorbed in the immediate vicinity of the charge. By applying this energy simultaneously over a relatively large circular area of the earth's surface, the energy per unit of area may be small, but the total energy can be made quite large, and the fact that this automatically produces a flat wave front tends to minimize the inverse square loss.

Numerous methods for producing a flat wave front over a large area have been studied, and several methods have been developed. One of the methods effectively used was a modification of the Munroe effect, or lined shaped charge, which had proved to be such an effective weapon during the war.

This charge was modified in such a way that instead of producing a long narrow jet, it produced a symmetrical umbrella-shaped jet by means of which it was possible to produce an essentially flat wave front 80 feet in diameter. Although good reflections can be obtained in many areas by this method, using a single charge, other types of charges fired singly or in multiples have been found to be more convenient in actual field operation.

If a flat circular charge of high-velocity explosives is suspended several feet above the surface of the earth and in a horizontal plane, and this charge is detonated from the center, it will produce an essentially flat wave front over a circular area more than a thousand times the area of the charge. These charges can be fired singly or in multiples of uniformly shaped charges depending upon the difficulty or ease with which energy is transmitted through the weathered layer and the characteristics of the substrata.

Because of the velocity at which this wave front travels, it is necessary that all of the charges be detonated within an elapsed time of not more than one-ten-thousandth of a second. Several methods of doing this have been worked out whereby either the standard seismic caps can be utilized by using a modified or different type blasting machine, or by using the standard blasting machine and a modified blasting cap.

It is interesting to note that Dr. Poulter got an inspiration that developed into his new method of seismic exploration from experience in the Antarctic region, where he was scientific adviser and second in command of the Byrd Antarctic Expedition of 1933-35; in this expedition he had charge of meteorological observations and employed geophysical methods to investigate the relations of the snow cap to the adjacent ice and ground rock. There he observed the relation between intensity of explosion and wave transmission. The theory was later developed to the point where it engaged the interest of the Slick Institute for Inventive Research, which sponsored extensive field tests during the summer of 1947.

Under the auspices of the Slick Institute there was staged on November 5 a demonstration of the Poulter method at the Ebart ranch near San Antonio, which was attended by a large number of geophysicists. At this demonstration it was brought out that the most important single factor for best results is that the charge must be of cylindrical shape with a length six to eight times the diameter, detonated from the top of the charge.

In general the verdict of the visiting geophysicists was favorable. The only important difference of opinion was over corrections for velocity of the reflections through the weathered zone. Some thought that closures less than 200 feet would be difficult to detect; others thought that the first breaks, or refractions, would be useful enough for a close delimitation of the structures. The opinion was expressed that the new method did not have the advantage of "uphole time" which is a feature of the conventional method, but others pointed out that the Poulter method has so many possible techniques in the arrangement of shots that this difficulty can be overcome.

To date, the most outstanding success of the new method is that good reflections have been obtained in certain portions of the Edwards Plateau region from which no unsable records have ever been obtained by the shot-hole method, and in no area were the results any worse than those obtained by conventional shooting. Encouraging results are said to have been obtained in over-water shooting off the Gulf coast.

The Poulter method is covered by patents and is being made available to the industry through a general licensing program.

OIL IS ONE-FIFTH OF ECA SPENDING

First Six Months' Record of the Economic Cooperation Administration Shows United States to Be Spending One Billion Dollars Yearly for Oil and Oil Equipment

By Joseph Huttlinger

THE role of oil and oil equipment in the Economic Cooperation Administration is larger than originally planned. About 40 to 50 percent of crude oil and product needs of the 16 ECA countries in Europe (and dependencies) is being met by oil paid for by the ECA. It is unlikely that this percentage will drop below 40 during any of the four years of the program, and it could stay near 50 according to present plans. Because world supply has improved, the oil part is ahead of schedule according to officials, although the figures to measure this are in a nebulous state. In six months at least one country received its full year's estimate of ECA-financed oil, and many other countries are ahead of schedule. By the end of the first year of recovery on April 1, officials expect total oil supplies to the countries to have averaged about one million barrels daily, some five to ten percent larger than originally estimated. This includes imports financed by the countries themselves as well as ECA-financed shipments. And ECA's equipment financing may well be two to three times as great as originally planned.

In this program the United States is spending some five to six million dollars a day to buy the things 16 European countries need, and petroleum is a large factor. Walter J. Levy, head of the petroleum branch of the agency, said: "Of the total import program, oil plays a surprisingly large role. Of the total five billion dollars of United States assistance, about one billion is accounted for by oil products, oil transportation and oil equipment. That means probably more than 20 percent of the total money involved will be related to our industry."

So the current thinking is about one billion dollars. This is in sharp contrast to the so-called "brown books" of the State Department, handed to Congress last April when the ECA idea was being considered. These estimated the oil part of the program at close to half a billion dollars in the first year. ECA and State Department officials explained the figures were wispy at the time, and they fervently wish they had not had to present them to Congress. For deviating from them, they fear they may have to face embarrassing questions.

Lest there be any misunderstanding, ECA is the current name for what has also been known as the Marshall Plan, after the Secretary of State, and the European Recovery Program (ERP). It operates under the Foreign Assistance Act of 1948. The program depends upon annual appropriation from Congress; thus its size in the next three years can only be guessed.

At the six-month mark ECA has spent between $203 and $245 million to buy crude oil and products for the countries. It spent another $50 million for transportation. It will spend more than that in the second half of the first year, officials say. It expects to spend close to $200 million more for equipment for the oil industry for an overall total of close to one billion dollars. These are impressive figures, but only because oil is an impressive part of world economy.

Some countries have been receiving more crude and products as ECA gifts than tentatively estimated when the plan was drawn up. Thus Greece in the first six months received, according to the best estimate, its whole year's scheduled supply. Austria, Denmark and Great Britain received more supply than the original plans called for. Italy got at least $31,930,000 worth of crude oil and products in the first six months; the program scheduled it to get but $39,200,000 in the first full year.

In a few countries the opposite took place. Thus France was able to take care of its needs by itself to a greater extent than expected. As a result, it got less ECA funds for petroleum—some $44,633,000 compared with the year's schedule of $122,400,000 worth. It has thereby saved credits against ECA which it can use for another commodity, cotton for instance, or for petroleum at a later date. Also behind schedule, but only slightly according to ECA figures, are the Netherlands and the French Zone of Germany. Norway, China and Bizone Germany were other recipients in the first six months.

Far more interesting and significant would be figures on total imports (locally and ECA-financed) under the recovery program. They would show the overall impact of the program.

In the absence of such figures, we have only an indication. Thus 15 of the Marshall Plan countries were able to import in the first half of this year a total of 159 million barrels of crude oil and products, which represented a 29 percent increase over the first half of 1947. This refers to total imports paid for by the countries' own dollars and any other source. Since the ECA was functioning only in the latter part of this period, its dollars may have been only part of the cause of the increase.

An improving world supply picture, spurred by daring exploration and development in various areas of the world, is the chief reason why there has been more petroleum for the ECA countries. Total United States supplies during the first nine months of this year (production plus imports) rose by ten percent over the same period a year earlier to about 6,300,000 barrels daily. Improvement outside the United States was even more impressive, the ECA explains, with crude oil production averaging more htan 3,600,000 barrels daily during the first half of the year. That represents a 19 percent increase over the comparable period a year earlier.

The outstanding fact of the ECA, however, is production, refining and distribution equipment of all kinds. Most oil men know it, but public officials rarely say outright that the equipment part means United States dollars are going to be employed to build up foreign competitors. Mr. Levy lays this down flatly.

"The ECA recovery program," he believes, "means an apparent sacrifice now and in the future for American business. It involves willingness to finance competitors in the oil industry in building up their facilities and organizations to operate in future world markets in order to permit western Europe to be able to meet its international balance of payments and get on its feet.

"However, without such a program, there would be neither enough oil to supply the ever-growing needs of the world, nor might there be a free world in which our nation could prosper."

The equipment part started slowly. Only a few authorizations for equipment were put out in the first six months. This phase was bogged down in controversies of many kinds. One is the availability of steel from the United States and whether it should go to Europe, stay in America or go to American companies abroad. Another is what countries should get the steel. Great Britain versus France, for instance. Another is to figure out where refineries and the like are most needed to help the flow of crude oil from one part of the world in a smooth stream into finished products for markets of Europe.

Acting safely, the ECA made one of its first awards to Italy, a promise to pay $1,350,000 for equipment, chiefly for refining but also for production and storage facilities. There will be many more equipment authorizations. ECA officials estimate spending $150 to $200 million for

equipment in the first year. This is well above the $67 million the United States was to spend according to the "brown books." Over the full four years of the program, the 16 countries would like to spend about $1,848 million for equipment in their own and ECA funds. They envision building up refining capacity to a level never reached before in the eastern hemisphere and increasing their drilling, production and refining in other areas of the world.

The twin expansions of Middle East production and European refining are the keys to the oil part of the recovery plan, according to government officials. Mr. Levy believes there's already been a dramatic improvement in refining capacity. He said the continent could handle but 380,000 barrels daily in refineries at the start of this year, but it will increase to 500,000 by mid-1949. The French capacity, now about 90 percent of prewar, has been pacing the increase; and Great Britain, the Netherlands, Bizone Germany and Italy have come along nicely, he said. By the end of 1952 the Marshall Plan countries hope to reach a target of one million barrels daily in refineries. And companies of the Marshall Plan countries plan to raise refining capacity outside of Europe and of the United States from 1,000,000 to 1,400,000 barrels daily by the end of 1952. At the same time the non-European and non-United States crude oil production of these companies is aiming at an increase from 1,000,000 to 1,800,000 barrels daily.

This ambitious plan is the goal. Only a few in Washington think it will be achieved in full, but they are certain that, with the aid of the recovery program, a substantial part of it will be accomplished.

A constant concern in administering the oil part of the recovery program centers around prices. It is not so much concern with premium prices that bothers ECA administrators. They flatly refuse to pay these on the ground that it would be against the intent of Congress which wanted funds to go as far as possible. They also fear that if they went along with premium prices, that Congress might object.

But the price of Middle East crude and products looms as a steady, perplexing problem. Just what the price of a barrel of crude oil in the Middle East should be has worried many in the United States government for some years. The question is whether the fair price is one that compares with United States prices or one that compares with the actual cost of production. In taking action, the ECA apparently follows the practice of the U. S. Navy which follows a middle course.

A potential embarrassing development in this field narrowly was averted. At least, it probably has been averted. In its six-month report the ECA put out tables showing the quantities, values, sources and destinations of various petroleum products which it financed. Russell B. Brown, general counsel of the Independent Petroleum Association of America, studied the report closely, and concluded that the ECA tables showed the agency was paying for Middle East products more than the lowest posted Gulf Coast prices.

For instance, he found that motor gasoline was selling for 11.9 cents a gallon in the Middle East to the ECA, while the lowest posted Gulf Coast price was nine cents. This was according to ECA's own announcement. He found the higher Middle East price structure also true of kerosene and heavy and light fuel oils. He estimated the report showed ECA paying an average price for Middle East crude and products of $2.72 a barrel. And he recalled that Congress forbade the ECA to pay more than prevailing United States market prices, although there are varying interpretations of what this means. He recalled, too, that the investigating committee of Sen. Owen Brewster, found fault last April with oil prices to the Navy during the war of $1.05 a barrel.

The report had been mimeographed and distributed to hundreds in the industry. Mr. Brown was prepared to make public his findings about them, but he remembered his findings could echo through Washington and the world to the detriment of the recovery program. Instead, he spoke with ECA officials about the figures, and they did what he had expected. They refused to stand by the figures and put out a sharply revised set. The corrected figures show the price of Middle East crude oil and products down to $2.49 a barrel, but a note says the figures are not complete for the six-month period. Paul G. Hoffman, ECA administrator, is reported taking a hand with a view to getting more Middle East oil for less ECA money.

The original figures had said ECA spent $245 million for crude oil and products to 15 of the countries, and of this 71 percent went to Great Britain, France and Italy. The corrected figures scaled down the value to $203 million. The original figures had said that ECA paid for 32,200,000 barrels from the Middle East valued at $87 million. The "corrected" figures pulled this down to 27,260,000 and $67,919,000.

The original table had said the ECA bought 25 million barrels for $84 million in the western hemisphere outside the United States, and the "corrected" table pulled this down to 21,200,000 barrels and $67,880,000. The original had put the United States purchases at 11,300,000 barrels for $74 million, but the "corrected" table said 9,729,000 and $67,275,000.

The original list was made up in a hurry by an under-manned organization in order to meet a deadline. The "corrected" figures giving the official story of ECA purchases through the first six months of the program are given in the accompanying tables.

ECA Programmed Shipments of Crude Oil and Refined Products by Products and Source

Six months—April-September, 1948 (corrected)

	Source and Quantity (1,000 barrels)				Source and Value (1,000 dollars)			
Commodity	United States	Other Western Hemi.	Middle East	Total	United States	Other Western Hemi.	Middle East	Total
Crude Oil	925	5,690	17,786	24,401	$ 2,603	$14,680	$38,717	$ 56,000
Aviation Gasoline	1,235	141	34	1,410	8,620	937	228	9,785
Motor Gasoline	2,040	5,184	2,438	9,662	8,591	19,722	9,384	37,697
White Spirits	121	35	—	156	575	153	—	728
Kerosene	199	2,985	887	4,071	784	11,765	2,930	15,479
Gas and Diesel	2,207	2,873	1,167	6,247	8,263	9,303	3,967	21,533
Fuel Oil	217	4,249	4,930	9,396	563	10,996	12,586	24,145
Lubricants	2,164	—	—	2,164	29,409	—	—	29,409
Solid Petroleum Products	621	41	19	681	7,867	324	107	8,298
Total	9,729	21,198	27,261	58,188	$67,275	$67,880	$67,919	$203,074

Notes: 1. Countries for which a program has not been fully determined are excluded from this table; in addition more than half the programmed shipments for Greece have been excluded because a final breakdown of quantity and value by source is not yet available.
2. Value and quantity figures are preliminary estimates subject to amendment as and when data on actual transactions become available.

ECA Programmed Shipments of Crude Oil and Refined Products by Country of Destination

Six months—April-September, 1948 (corrected)

	Quantity (1,000 barrels)			Value (1,000 dollars)		
Country	Crude Oil	Refined Products	Total	Crude Oil	Refined Products	Total
Austria	—	93	93	—	$ 591	$ 591
Denmark	51	2,695	2,746	122	10,612	10,734
France	12,246	2,413	14,659	29,568	15,065	44,633
Germany-Bizone	699	—	699	1,451	—	1,451
Germany-French	7	481	488	15	2,635	2,650
Greece	—	1,148	1,148	—	4,508	4,508
Italy	8,704	2,715	11,419	19,251	12,679	31,930
Netherlands	—	2,775	2,775	—	10,799	10,799
Norway	—	1,590	1,590	—	5,902	5,902
United Kingdom	2,694	16,395	19,089	5,593	69,389	74,982
French No. Africa	—	2,439	2,439	—	10,052	10,052
Other French DOT's	—	1,043	1,043	—	4,843	4,843
Total	24,401	33,787	58,188	$56,000	$147,075	$203,075

Notes: 1. Countries for which a program has not been fully determined are excluded from this table; in addition more than half the programmed shipments for Greece have been excluded because a final breakdown of quantity and value by source is not yet available.
2. Value and quantity figures are preliminary estimates subject to amendment as and when data on actual transactions become available.

DIAMOND BITS IN OIL

By Patrick Adamson

THE anticipated world demand for oil in 1951 is slightly under four billion barrels, which means a production and refinery increase of about two million barrels per day above the 1947 average. Prospecting for oil, therefore, has assumed great importance, and more complete geological knowledge of known fields is becoming even more essential. If production cannot be increased substantially above present levels, the United States will become a large importer of crude and products by 1951.

To meet these demands, the oil industry has a program of over 40,000 wells to be drilled in 1948 and over 7,000 wildcats. The state of Texas alone has a program of 27,000 wildcat wells. One of the factors influencing this current drilling activity is the steel shortage, which has caused a trend towards shallower development wells and increased wildcatting. The average depth of wells today is 3,500 feet, but production has been obtained from 14,000 feet. Most of the very deep wells, ranging up to 17,823 feet, have been dry, but as the average discovery is only one in eight or nine wildcats, this does not mean that oil is not discoverable at great depths. Geologists believe that new horizons of oil await the driller below present-day levels and that the day of 20,000 foot wildcats is not too far distant. Undiscovered reserves in the United States have been estimated at 50 billion barrels.

Production costs are rising steadily, and the effect of increasing depth is an increase in product price. After the 10,000-foot level is passed, most wells become "hard rock drilling" and even shales and sedimentary formations become slow to drill. It can be assumed that after 15,000 feet has been passed, all drilling, regardless of the geological formation, will be about equally hard to penetrate and equally costly. The best geophysical and other non-drilling prospecting methods are merely indications of structure and possibility of oil accumulations, and these highly developed methods have almost reached their limit of usefulness in deep prospecting. The drill is, therefore, becoming the most reliable prospecting method, but the cost is such that real economies have become essential. Unless substantial decreases in drilling costs are obtained, we shall have reached a bottleneck in the future of deep oil development. Every effort must be directed toward obtaining increased wildcat footage per dollar invested, or vast resources of petroleum will remain beyond the economic reach of the oil industry.

These facts are constantly in the minds of production men, and there has been a constant improvement in equipment and production methods. But while surface machinery has become highly developed and metallurgical improvement of tools has taken place, sub-surface drilling efficiency has not kept pace. On surface, the greatest engineering ingenuity has been applied to the relatively simple problems of hoisting heavy weights and pumping adbrasive fluids under high pressure, and so this part of the drilling operation is highly developed. Down-the-hole practice still follows the same principles, with minor changes, used in the early days of rotary drilling.

Apart from the time spent on the cementing, testing and completion of wells, the only productive time on a drilling rig is when the bit is on bottom and turning. The efficiency index is the percentage of total time spent with the bit on bottom, and future economies must be directed to that part of the drilling operation. Savings other than in direct drilling time, such as accelerating hoisting beyond the present-day procedures, mean greatly increased equipment costs. which offset the gain in time.

In surveying available methods of drilling, other than conventional rotary, with the object of determining where economies might be effected, we find cable tools, hydraulic percussion, hydraulic turbine, electric motor, shot drilling and diamond drilling. Of these methods, cable tools and shot drilling have been used for many years and have been highly developed for shallow work, but there is no indication that further development will include them as deep drilling potentials. The other methods are still in the experimental stage, with the notable exception of diamond drilling, which has been used for many years in the mining industry and has now been adapted to oil field operation.

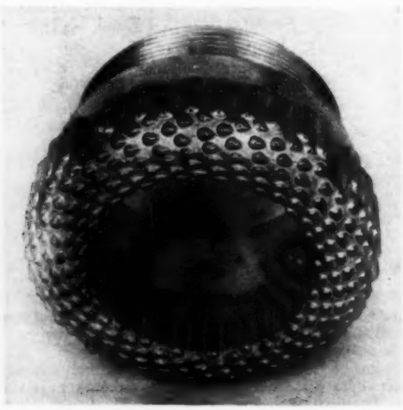
The recent development of diamond drilling in the oil fields started in the West Edmond field, Oklahoma, and in Rangely, Colorado, and the latter operation has been well described in various publications within the last year.

Since then, diamond drilling has spread to many fields in the United States as well as to Canada and South America. The Rangely operation was so ideal for diamond drilling that results obtained there are little guide to what may be expected elsewhere. However, both diamond bits and core barrels have been improved rapidly to meet a wider variety of drilling conditions, and excellent results are now being obtained in widespread operations.

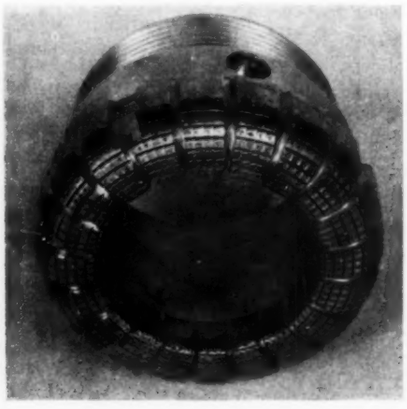
Before going into the future possibilities of diamond drilling and the equipment and techniques necessary to reach extreme depths, it might be well to review the medium that makes this method possible. Diamonds are the hardest substance known; when used as an abrasive, they will wear down any other substance. Diamond drilling is, of course, a grinding operation and so it follows that diamonds are capable of penetrating any rock formation encountered. The relative hardness of a diamond has often been misunderstood because of its rating on Moh's scale, where we find quartz rated at 7, corundum at 9 and diamonds at 10. A better picture can be formed by studying the results of the inden-

Standard, all-purpose, diamond oil field bit.

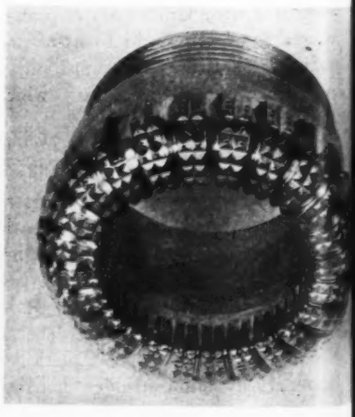
Large stone bit for drilling homogeneous sandstones.



Fine toothed diamond bit suitable for quartzite and chert.



Light weight bit suitable for softer limestones and shales.



tation tests reported by the U. S. Bureau of Standards in 1939. Here we find quartz rated at 710-790, corundum 17-2200 and diamonds 8200-8500. Instead of quartz being 7/10ths as hard as a diamond as in Moh, we find it 1/10th as hard by indenter.

This is a truer comparison, although other authorities have estimated diamonds at 17 times harder than any other known substance. Chert, the driller's nightmare, is relatively soft compared to a diamond, but it is finding the correct application of diamonds to chert that presents difficulty. Because there is a romantic aura attached to diamonds in the form of gem stones, one is invariably asked a great many questions about them, and many of the ideas that seem to be prevalent are, in fact, erroneous. Literature on the subject of diamonds is voluminous, but as the same questions are invariably asked by users, or potential users, of industrial diamonds and diamond bits, it might be well to answer them here.

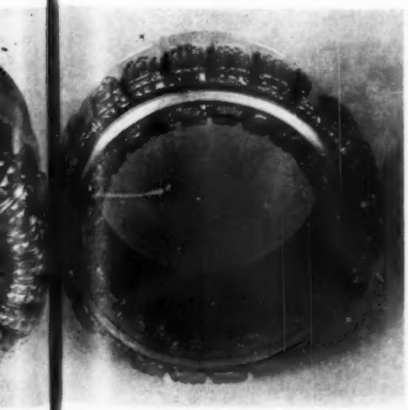
(1) Where do diamonds come from? Diamonds are found mainly in South Africa. Diamond-producing regions throughout the world include the Union of South Africa, the Belgian Congo, Angola, the Gold Coast, Sierra Leone, Tanganyika, Rhodesia, Ubangi and scattered districts throughout West Africa. Other countries producing diamonds include Brazil, India, Venezuela, British Guiana, Borneo, Australia and the United States. Quantities found in the last four named are negligible. Production outside the African continent is probably not more than six percent of the total.

(2) How are industrial diamonds mined? Are they by-products of gems? Diamonds are mined by conventional mining methods according to the nature of the deposits. South Africa produces deep pipes of what is known as blue ground as well as alluvial deposits. The pipes were originally mined by open pit methods but are now underground operations. Other deposits throughout the world are alluvial, and where pockets occur, open pit methods are used; otherwise development is by power shovel. Recovery of the diamonds from the ore or gravel is effected by washing and passing over vibrating grease tables. Diamonds occur in four different forms, which vary in molecular and crystalline structure. These are Bortz, Congos, Carbonados and Ballas. Carbonados are found only in one part of Brazil and are generally known as "black diamonds." Stones used industrially are those which are flawed, ill-shaped, discolored or otherwise not suitable for cutting into gem stones. The percentage of gem stones varies greatly in different deposits. South Africa, the Gold Coast and Sierra Leone run high percentages of cuttable stones. Brazil is slightly lower, and other regions produce a preponderance of industrials. The Congo produces a very small percentage of cuttable material, while ballas and carbonados are not suitable at all.

(3) What are the greatest uses and qualities? The greatest use, by weight, is now in diamond wheels which use Congo material crushed to various grit sizes. Other industrial uses include

Light portable rigs would be capable of drilling true slim holes to great depths with diamond bits.

Insufficient fluid volume, caused diamonds on face of the bit to burn. Breakdown then occurred in a deep groove.



Effect of continued drilling after pump failure. All diamonds have been destroyed.

Illustrating result due to brittleness of diamonds caused by running bit over "junk".

Illustrating result of excessive fluid volume and possible kink in lower end of core barrel.

Core is shown protruding from diamond bit and core barrel. This solid core had to be broken into lengths as it came out of the barrel.

wheel dressing tools of many types, boring and turning tools, contact points, precision gauges, hardness testing, wire-drawing dies, drilling bits, cutters and drills in the ceramics and glass industries, stone saws, engraving and etching tools, lens polishing, bearings, dental drills, phonograph points and diamond powder for cutting and polishing other diamonds.

(4) When were diamonds first used for drilling, and when were diamonds first mechanically set? Diamonds were first used for drilling rock in 1862, and until 1926 only carbonados were hand set in the crowns. The first mechanical setting by molten casting was perfected in 1930, and by 1938 almost all setting of bits was done in this way. In 1937 the first abrasive resistant, powdered metal, matrix, was developed by the Wheel Trueing Tool Co., and this is the type in general use today. The technique has been constantly improved as new drilling conditions are encountered.

Part of a diamond bit core showing tooth marks of previous rock bit. The formation contact is clearly shown. Coring was started at exactly the right depth.

(5) How hard is a diamond? The true hardness of all types of diamonds appears to be the same, but their lasting qualities as abrasives differ due to their internal structure. During the early diamond drilling experiments at Rangely, it was found that diamond bits would not only recover 100 percent of the cores cut but would actually make holes at a substantial saving of time and money. This is not always the case, and diamond bits do not show any advantage as a drilling medium in some of the softer formations. However, the instances where they do show savings are increasing as the products and the operating techniques are being improved. At the present time diamond core bits are being produced for petroleum drilling in sizes ranging from 4¾ inch cutting a 2¼ inch core, to 8¾ inch cutting a 4⅞ inch core. Several types of bits are available, as it has long been realized that a variety of designs will be required. Since the productive zones may comprise formations varying from soft anhydrite to hard quartzitic sandstone or chert, bits must be available that will perform efficiently in any formation penetrated. No one type or design of bit will do this. In general, softer formations require extra diamond clearance over the matrix metal, but when severe abrasive action is anticipated, the diamonds are set deeper in a hard tungsten matrix to afford them protection. Designs are also available for use in formations that contain broken or fractured chert, where diamonds would be sheared off or broken by fragments rolling under the bit.

Broken fragments and junk will cause severe damage to diamond bits, for the diamonds, though hard, are brittle and will not withstand percussion. They must be kept cool while being applied to the rock with uniform pressure and at a constant rotational speed. The penetration speed of diamond bits varies from 20 minutes per foot in hard siliceous shales to as low as 30 seconds per foot in unconsolidated sandstones. The general average is eight to ten minutes per foot. In addition to formation changes, other factors control the rate of penetration to a considerable degree. Highly viscous drilling fluids, incorrect fluid volume through the bit, instability of the core barrel, poor control of weight on the bit and improper rotary rpm are a few of the variables which may contribute to poor rates of penetration. The operator must have a clear understanding of the way in which these factors may be varied in different formations in order to obtain peak diamond performance at all times.

Penetration rates are very sensitive to the nature of the formation being drilled, and temporary slowing down of the cutting rate does not necessarily mean that the bit is worn out. So long as a steady penetration is maintained and the pump pressure reading remains constant, it may be presumed that the bit is still in good condition. This knowledge has prevented many needless trips.

When core recovery is the primary object, diamond drilling is extremely effective, because 100 percent core recovery is obtainable in nearly all cases, and the cores are in excellent condition for laboratory analysis or for picking formation contacts. Where the action of a conventional core head tends to fracture softer or broken cores and, due to the flushing action, causes excessive core loss, the diamond bit can recover even the very porous and vugular sections of the pay formation and allows a more thorough reservoir analysis. This high percentage of core recovery is of great assistance to geologists and engineers in completing wells, estimating reservoir conditions and in determining porosity, permeability, conate water and recoverable oil.

It would appear, therefore, that diamond drilling may well be one answer to the problem of economy in deep drilling, and operations to date certainly justify further experimentation along that line. One of the factors that will help such a program is the trend toward automatic controls on rotary rigs. The fully automatic rig is already on the way, and much of the variation of weight and rotary speed encountered at present will be eliminated in future drilling operations. Furthermore, true slim hole drilling to 20,000 feet should be possible with diamond bits. The limitations of bearings and the physical dimensions involved make the successful building of small rock bits difficult. It is generally conceded that bits smaller than 6¾-inch diameter do not approach the performance of larger diameter bits and are not efficient in comparison.

This consideration of size does not affect diamond bits, and in fact 4¾-inch diamond bits have already drilled below 17,000 feet, penetrating a thick quartzite zone below 15,000 feet which has previously been found impossible to drill. It is likely that special alloy drill pipe and other safety measures may be necessary, but there is little doubt that the ability of a four-inch diamond bit to stay on bottom for long periods and to cut the hard formations to be expected at great depth at a high penetration rate will eventually make this type of project economically possible. Certain factors make diamond bits particularly suited to these conditions, such as their smooth cutting action and the light weights required. Moreover, diamond bits can be manufactured to close tolerances, and recent developments in specially designed core barrels would make 50-foot runs easily possible in formations that defy drilling with small rock bits. In addition the small circulation rates, small drill pipe and comparatively small rigs required will all help in reducing the cost of deep prospecting.

Hard rock drilling such as limestone, which occupies 50 percent or more of the active drilling areas of the world, is wide open for diamond drilling, and the potential field is, therefore, large enough to justify further development and expenditure until the dream of the future becomes an everyday production method.

NINE NEW BUILDINGS HOUSE SINCLAIR RESEARCH WORK

E. C. Herthel, Manager, Sinclair Research and Development Laboratory.

SINCLAIR REFINING CO. recently opened a new research and development center at Harvey, Ill., to house its staff of more than 500 technical workers and assistants. The plant consists of nine buildings with 215,000 square feet of floor space grouped in a 20-acre area within a 38-acre site. Plan is such that any building may be enlarged without encroaching on its neighbor. Head of the new center is Eugene C. Herthel, manager of Sinclair's research and development department. Details of planning and construction of the plant were supervised by H. C. Kuhn and A. H. Eron.

A feature of the center is the new engine laboratory which was designed after an extended period of study and incorporates features intended to insure complete and uniform control of test conditions. These relate to the elimination of vibration which would interfere with the accurate operation of recording instruments, air purification and other atmosphere controls. The vibration problem has been eliminated by the use of massive, independently supported inertia blocks. Each engine test bed is supported independently of the building on two concrete arches. Steel girders mounted on these arches give them stiffness and support the Korfund isolaters, which are used to reduce the transmission of engine vibration to other test beds and the surrounding building. On the larger installations, eight of these isolaters are used. Riding on these isolaters is an inertia block of steel-reinforced concrete which measures 16 x 5 x 4 feet. Bolted to this concrete block is the case iron engine test bed, carefully machined and leveled. These test beds are six inches thick and weigh nearly a ton.

The engine laboratory is divided into 11 test cells, each of which house from one to four test engines. Each test cell has its own separately controlled ventilation system. The continuous supply of air to the cells removes dust and dirt and keeps the temperature of each cell constant. The exhaust from an engine being tested is piped down into the basement of the building, where it is water-cooled and ejected to the atmosphere by a separate, forced-draft ventilation system.

The test cells are built in two long rows running lengthwise through the building. Between these rows are control rooms from which all operations can be automatically controlled and the results observed and recorded in a quiet, ventilated room away from the noise of the test. The wall between the test cells and the control room is made of two six-inch cement blocks with a two-inch air space between the blocks. The observation windows for each test cell are mounted in fiberglas for soundproofing. Three panes of glass, ¼, ⅜ and ⅝ inch in thickness, are used in each window. Doors to the test cells are soundproofed. A monorail crane above each test bed is used to position the test equipment.

The three-story, U-shaped main laboratory contains 60-odd individual laboratories which have been arranged across the base of the "U" and in the two wings. This arrangement permitted installation of the required laboratory utility mains in a pipe tunnel around most of the perimeter of the building. Utility branch raisers are carried in the space between the brick outer walls and the tile inner walls. Services enter each room in compact standard groupings which can be connected with a minimum of piping and wiring and entirely without overhead obstructions. Throughbolts have been spaced at regular intervals in the laboratory walls for use in the installation of equipment.

The pilot plant building is divided into six entirely separate laboratories. The outstanding construction feature of the building is the use of corrugated aluminum sheet to divide the building into six cells. This has been done to provide more flexibility, as the partitions can easily be removed if two of the cells are required for operation of a single pilot unit. The light walls and the special design of the roof minimize danger to personnel in case of an explosion. Offices and smaller laboratories are in the two-story part of the building. Cooling towers for recirculated cooling water are located behind the pilot plant.

The remaining research facilities are of simple single-story, steel frame and brick construction. These include a fuel application laboratory for the testing of oil-burning domestic furnaces and space heaters, an exploratory research laboratory for work with equipment too large to be handled in the main laboratory building and involving high pressure and special catalyst testing procedures, and a distillation, compounding and lube treating laboratory where 21-foot ceiling height has been provided to accommodate large-distillation equipment, garage facilities and storage space.

Instrument board recording conditions of engine operating in cell (behind window).

Main entrance to the Administration Building of Sinclair's Research and Development Laboratories at Harvey, Ill.

FIVE-YEAR PROGRAM DEVELOPS NEW FIELDS IN VENEZUELA

AFTER nearly five years of exploration and development work, Venezuelan Atlantic Refining Co. recently unloaded at Philadelphia the first cargo of 114,600 barrels of crude oil produced from its properties in Eastern Venezuela. The five-year program has developed production which now averages 8,500 barrels daily.

Although Venezuelan Atlantic has a considerable number of concessions in which it has an exclusive interest, current production is largely coming from fields developed on properties jointly owned with Pancoastal Oil Co., C.A. In all of the jointly owned properties held by the two companies totaling some 326,147 acres, Venezuelan Atlantic is the operator.

Most important find to date in the Atlantic drilling program is the Tucupido field in the State of Guarico. First well in this field was completed late in 1946. Since then, 12 wells have been completed as oil wells. Two other completions were gas wells, believed to be structurally high. Early in November production of the field was about 8,500 barrels daily compared with about 5,500 barrels daily in September. With four rigs running in the field and drilling not difficult, it is anticipated that production will increase during the coming year as potentialities of the area are explored. As mentioned previously, no dry holes have been drilled and the area of production has not yet been delimited.

Drilling pattern in the field at present is one well to 40 acres. The operators are not drilling any very extended step-out tests at this time, the rigs being used to build up a satisfactory volume of production rather than to explore field limits. Oil from the field tests 39.6 gravity produced from Oligocene sand found between 5,000 and 5,500 feet.

Outlet for oil from the field is an 11-mile, eight-inch line connecting with the Texas-Mercedes pipeline from the Las Mercedes field, 50 miles west, to the marine terminal at Puerto la Cruz, 107 miles to the east.

The Tucupido and adjacent concessions jointly owned by Venezuelan Atlantic and Pancoastal embrace 37,000 acres in 30 parcels. In addition to this acreage, Venezuelan Atlantic has wholly owned acreage both east and west of the field. This acreage totals 27,000 acres and as yet has not been tested. Step-out drilling being done at present on the jointly owned acreage is tending toward the east. No wells are being drilled west of the gas wells, assumed to be at the crest of the structure.

Second important discovery on joint properties of Atlantic and Pancoastal is the Pelayo field in the State of Anzoategui about 120 miles east of Tucupido. Production here was found in the Oficina formation of Oligocene age at 7,500 feet. The oil is heavier than in Tucupido, testing 28 gravity. Thus far, three producing wells have been completed, and one additional well is drilling. The three wells are shut down at the moment, pending completion of a pipeline. Tests indicated that production of the wells will be about 1,500 barrels daily. The jointly owned properties include 15,000 acres.

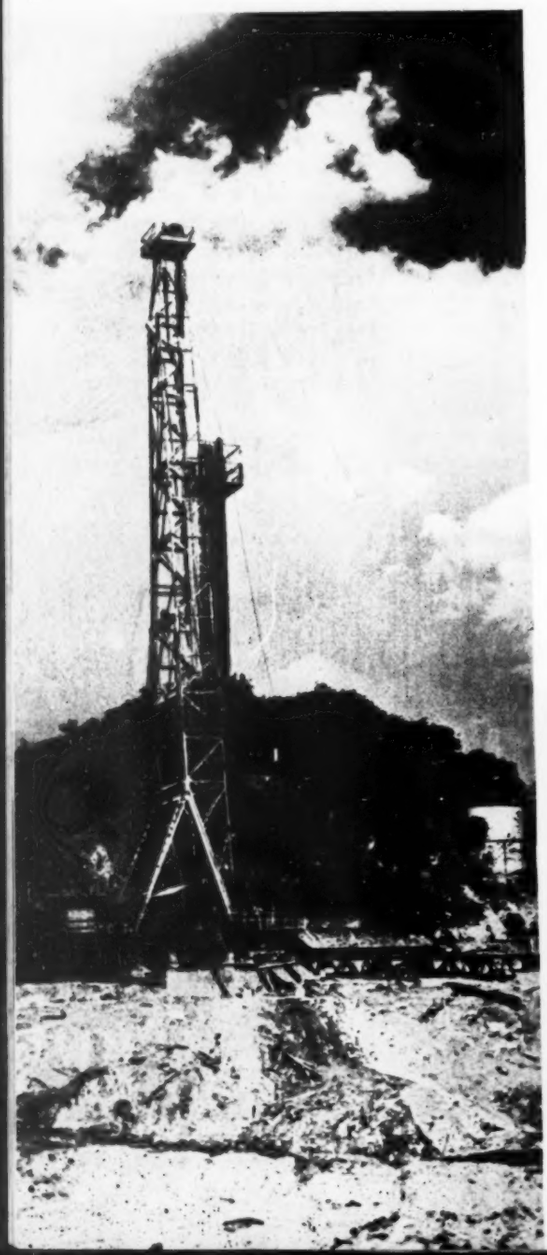
A pipeline outlet for Pelayo crude will be ready soon. Twelve miles of six-inch "invasion" pipe is being laid to connect with the Mene Grande line into the Leona field.

In this area, Venezuelan Atlantic has wholly owned concessions as well as the joint interest properties. From Pelayo on east into the State of Monagas, the wholly owned acreage totals about 80,000 acres. On one of these tracts, Atlantic is now drilling a wildcat well five miles east of Pelayo called "JUNTA #1." Early in November it was down to 4,700 feet.

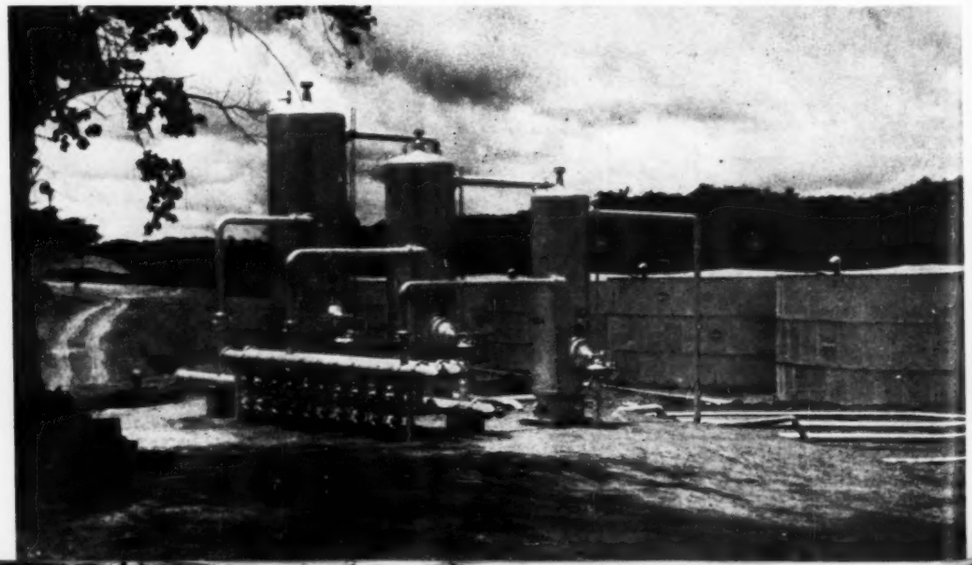
In the Tucupido district also Atlantic has some wholly owned properties. One of these is at Saban, a short distance to the south, where the company has paid exploitation concession fees on 12,500 acres. Drilling at Saban has found production at about 5,000 feet and additional sands, the possibilities of which have not been fully tested, are known to exist at 800′—1,000′ and at 2,500′. Plans have been made for further drilling. Pipeline has already been extended some 16 miles from Tucupido to Saban.

Midway between Tucupido and Pelayo, a well was completed at Socororo recently for about 125 barrels daily. With no pipeline outlet, the well was shut it at the time, but now another well is being drilled. If the area gives promise of being a good producer, a line will be laid to connect with an existing line about eight miles east.

Atlantic and Pancoastal also are considering a wildcat on the Ruiz concession, which is another block of undeveloped acreage where geological and geophysical reconnaissance work have been carried out. This property is about 18 miles southwest of Saban in the State of Guarico.



← Portable drilling rig operating in the Tucupido area.



↓ Tucupido station of the recently completed pipeline to Atlantic-Pancoastal properties.

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International News and Notes

Basil R. Jackson

Jackson Joins Anglo-Iranian Board

Basil R. Jackson, representative of Anglo-Iranian Oil Co. in the United States, has been elected a director of the company. He also is a director of Middle East Pipelines, Ltd., and Anglo-Bahamian Petroleum Co., Ltd. Mr. Jackson completed his legal training in St. John's, Newfoundland, and served throughout World War I in France and Flanders in the Royal Artillery.

He joined Anglo-Iranian Oil Co. early in 1921 and has been engaged in production, exploration and concessions, refining and sales activities of the company both in London and abroad. In 1930 he was appointed the company's first representative in the United States. He left New York in 1934 to accompany the then chairman of the company, Lord Cadman, on a world tour of the company's properties.

Mr. Jackson returned to New York after the outbreak of war in 1939 to take care of extension and development of Anglo-Iranian's interests in the United States. During World War II he served as one of two British observers on the foreign operations committee appointed by PAW to coordinate petroleum supplies.

Dr. D. T. A. Townend Heads Fuel Institute

Donald Thomas Alfred Townend was installed as president of the Institute of Fuel at a recent meeting of the London section. He succeeded Dr. C. H. Lander as president. Dr. Townend served during World War I in the Royal Naval Air Service and during World War II acted as part-time scientific adviser to the Ministry of Home Security, being particularly concerned with incendiary warfare.

Dr. Townend has had long association with the fuel efficiency branch of the Ministry of Fuel and Power, particularly as a member of its educational committee. He is now a member of the fuel efficiency committee and serves on the Domestic Coal Consumers Council. He is a member of the Fire Research Board and the Council of the Institution of Mining Engineers. He served on the D.S.I.R. Sibly Committee which reported in 1943 on the supply of fuel technologists.

Honor For Managing Director

J. B. Aug Kessler, for many years a managing director of the Shell group of companies and now general managing director of the Royal Dutch Co., recently was awarded the Companion of the British Empire for his valuable services in the petroleum field on behalf of the Allied war effort. The insignia of the order was presented to Mr. Kessler by Hugh Gaitskell, minister of fuel and power.

Mr. Kessler's father was the founder of the Royal Dutch Co. which joined forces with Shell more than 40 years ago. The son, now aged 60 years, has followed the family tradition in oil. After completing his education and qualifying as an engineer at Delft University, Holland, Mr. Kessler acquired experience of oil operations in Romania, Russia, Holland and many other countries, coming to London in a managerial capacity in 1919. He was soon appointed a managing director at the Group's London headquarters and rapidly became a leading figure in the world's oil affairs.

To Manufacture Amerada Gauge

Hilger & Watts Ltd., of 48 Addington Square, London S.E. 5, has arranged with the Geophysical Corp., Tulsa, Okla., for the sole license to manufacture the Amerada gauge in Great Britain.

Captain T. D. Kelly

CAPTAIN T. D. KELLY, head of the operations division of the marine department, Imperial Oil Ltd., has been appointed assistant manager of the marine department. Captain Kelly, who joined Imperial as a seaman in 1922, became a master in 1929. In 1940 before entering the R.C.N.R., he was mooring master and assistant marine superintendent at Talara, Peru. During the war he was commander of HMCS Prince David. He returned to Imperial in 1945 as operations manager of the marine department. Later he was temporary coordinator of executive development. Arthur T. Roblin, formerly assistant manager of the traffic department, has been named coordinator of executive development succeeding Captain Kelly.

GEORGE R. McMILLIN, assistant superintendent at the Imperoyal refinery of Imperial Oil Ltd., at Halifax, N. S., has been appointed supervisor of the central production control group, engineering and development division of the manufacturing department at Sarnia. Mr. McMillin joined Imperial at the Sarnia refinery in 1933. After spending short periods at Toronto and at Talara refinery, he was transferred to Imperoyal in 1939 as chief chemist.

Murdo MacLeod succeeds Mr. McMillin as assistant superintendent of Halifax refinery. Mr. MacLeod started to work for Imperial oil at the Calgary refinery in 1928. In 1937 he was appointed chief chemist and production controller at Regina. Six years later he became technical supervisor, western refineries. In 1946 he was transferred to Toronto as secretary of the operating advisory committee, manufacturing department.

May Suspend Basic Ration

There are very strong indications that the British government may determine to suspend the basic petrol ration this winter as a method of ensuring security of supplies for military needs in the European field. The RAF is using a very considerable volume of oil in maintaining the air lift into Berlin, and it has become a question whether this can be maintained and normal allocations for pleasure motoring maintained at the same time. The whole rearmament policy will also involve the government in a decision as to conserving oil for military needs as against private needs.

Completes Ten-Month Trip

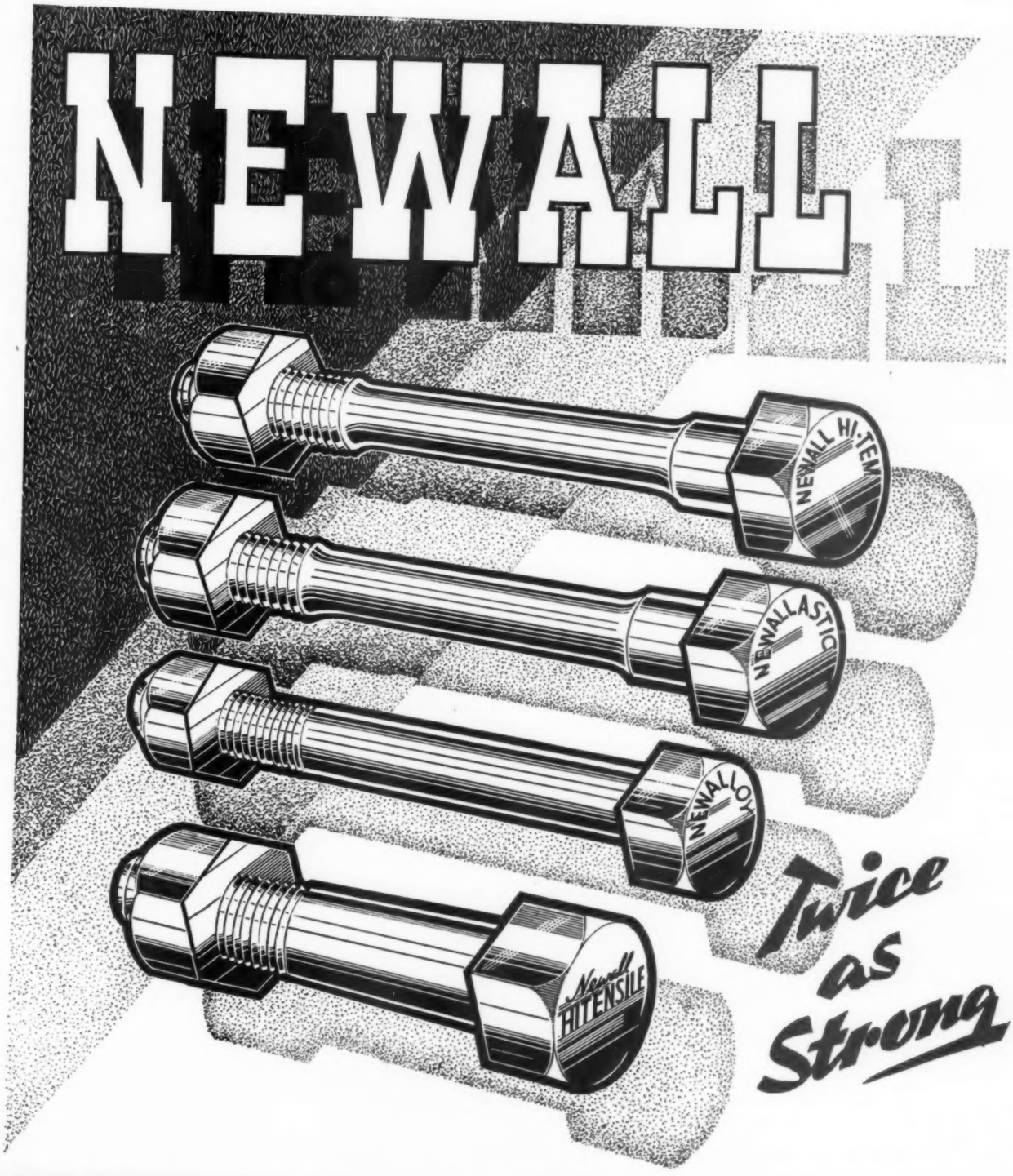
G. J. Pateneaux, assistant manager of the international division of the A. O. Smith Corp., has returned from a ten-months' trip to Latin America in which he visited all countries except Paraguay and Costa Rica. His trip was for the purpose of contacting distributors and studying general market conditions. A native of the United States, Mr. Pateneaux had lived and worked for 17 years in Latin America prior to the war.

A. J. SINGLETON has been elected vice president in charge of marketing west of Suez for California Texas Oil Co., Ltd. He succeeds A. C. Long who has returned to The Texas Co. as assistant to Chairman W. S. S. Rodgers.

Mr. Singleton, who was a director of the Petroleum Board in England during World War II, has been engaged in the oil business since 1924. Starting with Galena Signal Oil Co. (of Ireland) Ltd., he subsequently became managing director of the English subsidiary of The Texas Co. At the end of World War II he was appointed assistant general manager of the foreign sales division, and in 1947 when Caltex acquired the European interests of The Texas Co., he joined Caltex as assistant vice president.

Mr. Long, who now returns to Texaco, was graduated from the U. S. Naval Academy, Annapolis, and has been associated with The Texas Co. and affiliates since 1930 except for a period during World War II when he served as petroleum attache for the State Department in London.

A. J. Singleton



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OIL COMPANY STAFF CHANGES

Fred W. Shield

FRED W. SHIELD, San Antonio, Texas was elected president of the Independent Petroleum Association of America at its recent annual meeting in San Antonio. He succeeded Merle Becker.

Mr. Shield, well-known as an active independent operator in southwest Texas, has been in the oil business since 1926. At that time he operated from Burkett, Texas, with his interests being largely in Coleman and Callahan counties. His first ventures were shallow wells, and because of the success with these he expanded and entered the west Texas play. During the latter time he operated from Abilene, Midland and San Angelo, moving to San Antonio in 1939 where he has maintained headquarters to the present.

He is at present a producer of crude oil in Ector, Duval, Refugio, Bee, Nueces, McMullen, Jackson and Goliad counties in Texas. His producing operations are handled by his own organization, and in addition to this activity he is also engaged in the royalty business. Mr. Shield previously served as vice president of the association for southwest Texas and on the executive committee and as a director. He was elected president of Texas Mid-Continent Oil and Gas Association in 1945.

RAY H. ANDERS has been appointed director of purchases of Sun Oil Co. to succeed Henry Thomas who retired Dec. 1 after 36 years of service. Mr. Anders, until recently manager of Sun's industrial products department, will be assisted in his new duties by Roy A. Hurst, assistant director of purchases.

Mr. Thomas had been Sun's director of purchases since 1937. He joined the company in 1912 at the Marcus Hook refinery and during the succeeding years participated in the planning and building of many plants and pipelines. From 1916 to 1919 he helped to build and operate utilities at the Sun Shipyard in Chester. In the years 1933-36 he assisted in the final stages of development of the Houdry process, concentrating on the utilization of gas turbines.

JAMES ROY MAXEY has joined Deep Rock Oil Corp. as superintendent of geophysics. In addition to experience in all of the major domestic oil fields, Mr. Maxey has also done work in South America and Europe. He has worked with the Humble Oil and Refining Co., Carter Oil Co., Sohio Oil Co., United Geophysical Co. and Wichita Exploration Co.

E. Q. Beckwith

E. Q. BECKWITH has been appointed sales manager of LPG for the Sid Richardson Gasoline Co., Fort Worth, Texas. Richardson is building a large natural gasoline plant in the Keystone field near Kermit, Texas. Present plans call for the plant to be completed and in operation by February 1949, with a daily average production of approximately 100,000 gallons of propane and butane and 100,000 gallons of natural gasoline.

Mr. Beckwith has had wide experience in LPG sales, engineering and product procurement work with both the Phillips Petroleum Co. and the Beacon Petroleum Co. During World War II he was commanding officer of the Lima Tank Depot, Lima, Ohio.

L. T. BARROW has been elected chairman of the board of Humble Oil & Refining Co. Mr. Barrow has been with the company since 1924, a director since 1937 and vice president since 1938. He has been in charge of the company's exploration activities for the past ten years and prior to that was chief geologist. Mr. Barrow's studies at the University of Texas were interrupted by the first World War. He served in the Air Corps from October 1917 to March 1919. Completing his education after the war, he served as an instructor of geology at the University of Texas for two years prior to joining the Humble company as a division geologist in 1924.

L. T. Barrow

RAYMOND R. FALLER, former manager of employee relations in the Detroit research laboratories of Ethyl Corp., has been appointed coordinator of employee training activities in the industrial relations department of the company. His headquarters will be in New York. Mr. Faller joined Ethyl in 1931 as an automotive engineer. In 1939 he was transferred to Detroit as director of training. Following three years of service in the Navy, he returned to the research laboratories in 1945 to become manager of personnel and employee relations.

J. A. RAMSEY, formerly superintendent of Continental Oil Company's Wichita Falls, Texas, refinery, has been named superintendent of the company's $9,200,000 refinery under construction at Billings, Mont. Succeeding Ramsey as superintendent of the Wichita Falls refinery is J. P. Markey, formerly assistant superintendent there. He in turn will be succeeded by Norman Newton.

Assignment to the Billings refinery is a return to the Rocky Mountain region for Mr. Ramsey, who served as superintendent of Continental's refinery at Glenrock, Wyo., from 1941 to 1945. He was assistant superintendent of the Wichita Falls refinery from 1935 to 1941 and returned to Wichita Falls as superintendent in 1945.

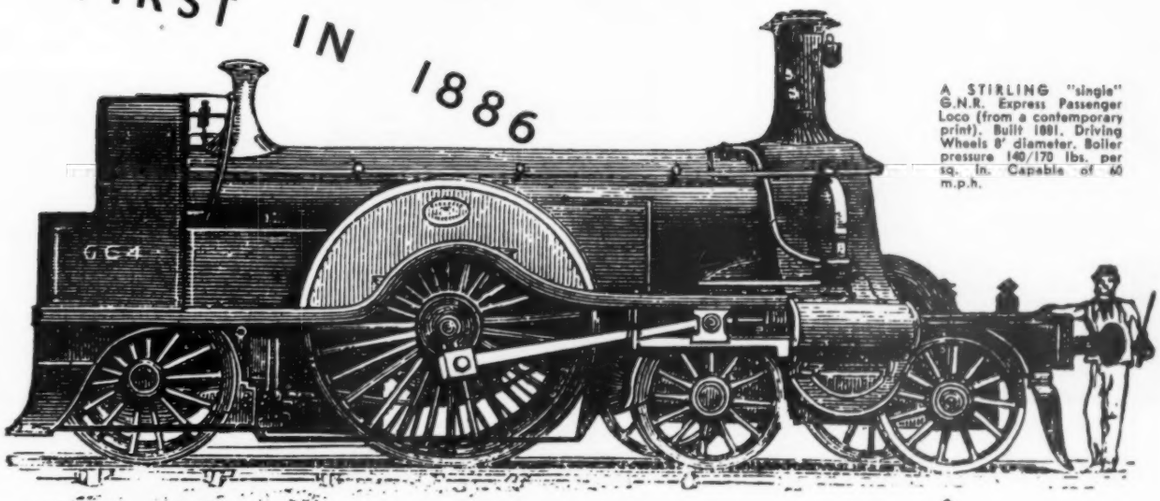
Mr. Markey moves into the Wichita Falls superintendent after an 18-year period with Continental. He went to Farmington, N. M., in 1937 to become refinery superintendent and was promoted and transferred to Wichita Falls in 1941 as assistant superintendent.

CARL TODD has been appointed chief geologist in charge of the Mid-Continent area for Bishop Oil Co. He has been in charge of the Kansas division and will continue at Wichita, Kansas, headquarters. Earl Moore has been appointed superintendent in charge of drilling in the Mid-Continent area. He has been drilling superintendent for the Oklahoma division and will continue his offices at Ada, Okla.

WILLIAM R. ARGYLE has been elected executive vice president of Sinclair Refining Co., in charge of manufacturing operations, and a director. He succeeds George H. Taber, Jr., who has retired. Mr. Argyle joined Sinclair shortly after World War I and was placed in charge of fuel and utilities covering all operations in its refineries. In 1924 he was appointed superintendent of the company's refinery at Marcus Hook, Pa. He took leave of absence for the duration of World War II to join the Petroleum Administration for War where he served as associate director of refining. In the summer of 1945 Mr. Argyle returned to Sinclair as assistant manager of refining, New York.

William R. Argyle

FIRST IN 1886



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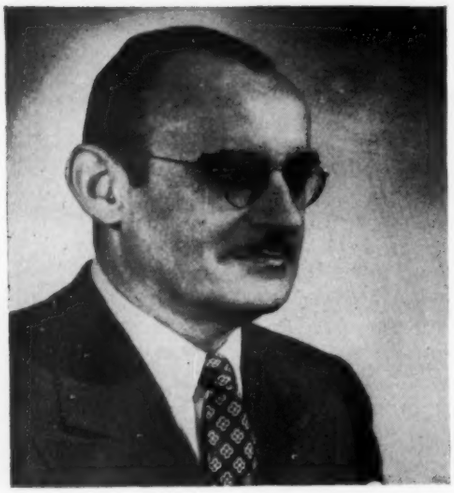


A. E. Lacomblé

M. E. Spaght

A. E. LACOMBLÉ, president of Shell Development Co., with headquarters at San Francisco, California, has been elected chairman of the board as of January 1, 1949. He will be succeeded by M. E. Spaght, now vice president. Mr. Lacomblé's career in the field of petroleum research and development began when he joined Shell in 1920 after receiving his doctorate in science from the University of Leyden in Holland. He served for five years in the Dutch East Indies and in 1926 became assistant superintendent of Shell's Martinez, California, refinery. Ten years later he was made vice president in charge of manufacturing for Shell Petroleum Corp., in St. Louis. After other executive assignments, he was elected president of Shell Development Co., in 1943.

Mr. Spaght, who has been with Shell for 15 years, began as a research chemist at the Martinez, California, refinery and by 1940 had become manager of Shell's manufacturing research and development at San Francisco. He was made manager of manufacturing west of the Rockies after special war work and was appointed vice president of Shell Development in May 1946.

ERIC G. LINDROTH has been elected director and treasurer of Esso Export Corp., an affiliate of Standard Oil Co. (N. J.). He was assistant treasurer of the Creole Petroleum Corp.

THE PRESIDENT'S certificate of merit for outstanding services during the war has been awarded to Dr. Lester M. Goldsmith, chief engineer of The Atlantic Refining Co. The award was in recognition of his services as a member of the Transportation Division of the National Defense Research Committee, Office of Scientific Research and Development. Dr. Goldsmith previously was honored for his contributions to the installation of an oil pipeline under the English Channel.

DON A. KLEMME, safety supervisor for Stanolind Oil and Gas Co., has been named general chairman of the National Safety Council's petroleum section for 1948-49. Mr. Klemme has served the petroleum section as vice chairman for production, drilling and exploration for the past three years. He succeeds W. I. Kent, safety director of the Magnolia Petroleum Co., Dallas, as general chairman.

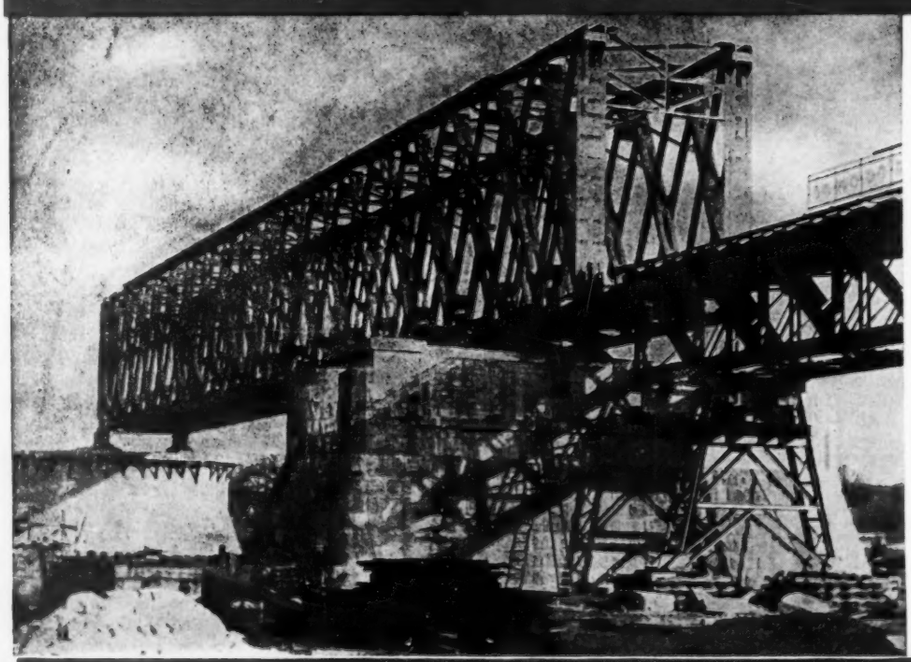
STANLEY D. BREITWEISER has been selected to head up Continental Oil Company's bulk lubricating oil sales activities. His duties will include the handling of sales of Continental's share of products from the big $41 million lubricating oil plant being erected by Continental and Cities Service Oil Co., at Lake Charles, La. The plant is due to be completed early next year. He formerly was division sales manager at Kansas City.

EDWARD R. GREY has been appointed superintendent of Mexican Petroleum Corp. of Georgia's Savannah refinery. In 1932 Mr. Grey was employed at the Texas City refinery of Pan American Refining Corp., an affiliate. In 1941 he was transferred to the Savannah refinery as chief engineer, and in 1944 was promoted to assistant superintendent in charge of construction and maintenance work.

British Tanker Expansion

Additions to the fleet of British Tanker Co., Ltd., affiliate of Anglo-Iranian Oil Company Ltd., now on order will raise the number of the company's vessels from 117 to 155, aggregating 1,850,000 tons. Sir William Fraser, chairman, expresses doubt whether this will be sufficient to meet the company's future needs, and later additions to the fleet are contemplated.

240 FEET SPAN



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Special patented features of the Callender-Hamilton Bridges enable them to fit almost exactly any required span, and thus use existing piers or abutments.

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New Schlumberger Catalog

Schlumberger Well Surveying Corp., Houston, Texas, has recently published a new catalog which presents illustrations and descriptive data on all of the 17 Schlumberg services available. Copies of this informative booklet are available on request.

Cooper-Bessemer Expands Engineering Facilities

The Cooper-Bessemer Corp. will build a quarter million dollar addition to its main office building in Mount Vernon, Ohio, to provide more adequate facilities for its rapidly expanding research and engineering divisions. The new addition will provide some 19,800 square feet of area exclusively for engineering and research activities.

Cooper-Bessemer's engineering and research division, like that of most important manufacturers in heavy industry, has grown tremendously in recent years. During the last three years, Cooper-Bessemer engineers have developed the revolutionary gas-diesel engine and have perfectd th Turboflow application to both two-cycle and four-cycle engines, thus cutting fuel costs substantially while increasing engine horsepower output by more than ten percent. In the metallurgical field they have aided progress in the use of cast iron by increasing its tensile strength.

Wins Distinguished Service Award

Among the major awards made at the annual convention of the American Society for Metals was the honoring of Robert W. Schlumpf, chief metallurgist of Hughes Tool Company, with a distinguished service award. Presented to Mr. Schlumpf at the annual banquet of the convention in Philadelphia, Pa., the award read "for outstanding work in the utilization of alloy steels in oil-well-drilling equipment." Mr. Schlumpf joined Hughes Tool Co. in 1924 and is considered a leading authority in the metallurgical field pertaining to oil-well-drilling metal processing.

Inaugurates Lecture Series

Universal Oil Products Co. has inaugurated a series of lectures to be delivered monthly at its Riverside Laboratories by outstanding scientists and technologists, to suggest and stimulate new lines of thought among Universal research workers.

The first lecture in the series was given on Oct. 11 by Prof. Carl S. Marvel, head of the organic division of the department of chemistry at the University of Illinois. His subject was "High Polymers" and involved particularly the chemistry in the polymerization of dienes in its relation to the production of synthetic rubber. The second lecture on "Polycyclics" was delivered on Oct. 25 by Prof. W. E. Bachman of the University of Michigan, and the third on "Hydrides," Nov. 16, by Prof. H. I. Schlesinger, University of Chicago.

Others on the current schedule includes: "Petroleum Substitutes," Dec. 13, by Dr. H. H. Storch, Pittsburgh Experiment Station, U. S. Bureau of Mines; "Silicones," Jan. 11, 1949, Prof. E. G. Rochow, Harvard University; "Halogenation," Feb. 14, Prof. E. T. McBee, Purdue University; "Role and Application of Reaction Kinetics in Analytical Chemistry," March 14, Prof. I. M. Kolthoff, University of Minnesota; "Peroxides," April 11, Prof. M. S. Kharasch, University of Chicago; and "The Function of the Consulting Chemist," May 9, C. S. Miner, head of the Miner Laboratories and one of the directors of Universal.

Henry D. Noll

Noll Heads Houdry Service Group

Henry D. Noll has been appointed manager of the Houdry engineering and technical service division. He came to Houdry five years ago after nineteen years of service with Socony-Vacuum Oil Co., Inc.

New Patterson-Ballagh Manager

T. M. Smith, Jr., has been appointed manager of field sales and service for Patterson-Ballagh Division of Byron Jackson Co. for the Texas Gulf coast. Under Tommy will be Ralph Snowden, located at Alice, and A. C. "Tag" Colgin at Houston. "Tag" will be transferred to Houston from Shreveport, La.

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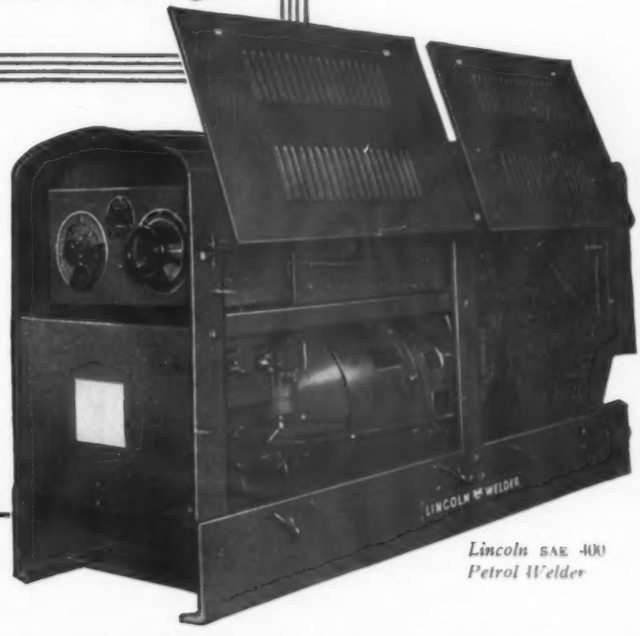

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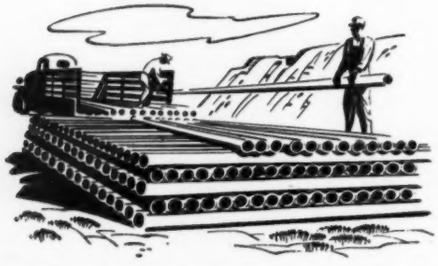
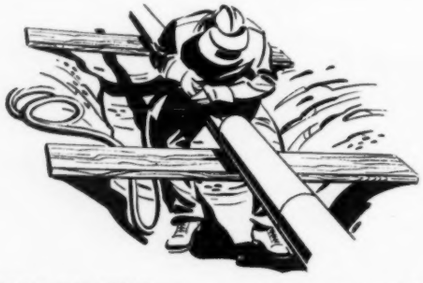


UNIFORM ROUNDNESS—Pipe ends match up perfectly, speed construction, cut costs. Uniform diameter and wall thickness are also important advantages of Republic Electric Weld Line Pipe.

EASY TO BEND—High ductility steel makes bending in the field easy. Long straight lengths line up evenly, go into the ditch freely, reduce the number of joints.



EASY TO WELD—Low carbon steel welds readily, makes sound joints. Uniform high yield strength permits building of higher pressure lines.

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Electric Weld Line Pipe

This modern line pipe means ease of installation, trouble-free performance and dependable long life. Republic Electric Weld Line Pipe is made from flat-rolled steel, both sides of which are closely inspected. The surface which becomes the inside wall when formed into pipe is therefore free from hidden defects. Every effort is being made to meet the unprecedented demand for Republic Electric Weld products, which have built a wide acceptance through years of dependable service to the oil industry throughout the world.

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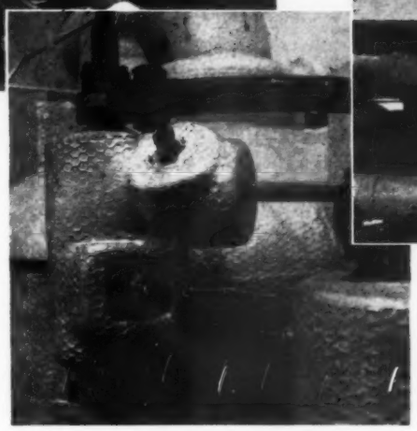

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New Tractor Catalog

A 24-page catalog featuring the Allis-Chalmers HD-5 crawler has just been released by the company's tractor division. Copies can be obtained by writing the Allis-Chalmers Manufacturing Co., tractor division, Milwaukee 1, Wis.

Opens Caracas Offices

George W. Walton, vice president in charge of machinery and export division of International Derrick & Equipment Co., announced the establishment of an office in Caracas, Venezuela, at which point Tom Alexander and Merwin Vollmer will be headquartered permanently. These men will accompany Mel Cooper on his various trips in Venezuela during his present sojourn in that country, Mr. Cooper being the head technical factory representative. The addition of Alexander and Vollmer to the South American sales force will place Ideco representatives at all key Latin American locations. Carey B. O'Connor represents the Ideco line in Brazil and Adrian D. Bolland in Argentina.

Nooter in Expansion Program

In Philadelphia to attend the thirtieth National Metal Congress and Exposition recently, representatives of the John Nooter Boiler Works Co., St. Louis, extended their eastern itinerary to include visits to suppliers and equipment manufacturers in connection with Nooter's current $500,000 expansion program. When buildings now being erected are completed and new equipment installed, the Nooter firm will be rated a Class I shop capable of handling steel and alloy plate up to two inches thick. The company fabricates tanks and vessels for the chemical, petroleum, foods processing and other industries.

Representing Nooter on the Eastern trip were: J. Harvey Yaeger, chief engineer; P. H. Smith, director of research and development; M. W. Lischer, engineer, and E. W. Kleefisch, supervisor of the firm's metallurgical laboratory. Mr. Lischer is a member of the board of the St. Louis section, American Welding Society, co-sponsor of the Philadelphia meeting.

Evans Wins Nomads Golf Cup

John Evans of Lucey Export Corp., won the president's cup at the annual golf outing of the New York Nomads chapter at Springfield, N. J., on Sept. 21. Low gross prize winner among guests of the chapter was William Dickenson of Standard Oil Development Co.

Main Prize Winners

Standing Left to Right: John Basehart, Buda Engine Company; John Evans, Lucey Export Corp.; Bill Dickenson, Standard Oil Development Co.; K. B. Ris, The Griscom-Russell Co.

Kneeling Left to Right: Joe Doran, International General Electric Co.; R. H. McKegg, Socony-Vacuum Oil Co., Inc.; H. Gottwald, Rockwell International Corp.

Winner of the prize for low net score among guests was John Basehart of the Buda Engine Co. Among Nomads K. B. Ris of The Griscom-Russell Co. had low net.

Other prize winners among the Nomads were Stewart Beckley of Brown and Beckley, Joe Woods of the Petroleum Engineer, H. Gottwald of Rockwell International Corp., George Woods of R. S. Stokvis and Sons, Inc., and Jeff Tucker of Mission Manufacturing Corp.

Among the guests, Harry McCobb of Standard-Vacuum Oil Co., Joe Doran of International General Electric Co., R. H. McKegg and R. E. Irby of Socony-Vacuum Oil Co., and William Cardwell of Cardwell Manufacturing Company were winners of other prizes. Forty who qualified as "expert" golfers were awarded sport shirts and golf balls. The non-experts were given a book by Bobby Jones on "How to Improve your Golf without Practice."

New Hughes Tool Director

Fred W. Ayers, senior vice president and managing director of Hughes Tool Co., announced the naming of Harry E. Rogers, vice president, as a director of the company. Mr. Rogers has been with Hughes since 1945, and has been promoted from manager of production to vice president in charge of manufacturing.

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rust inhibitor is
R.L.G. primer—Red Lead and Graphite
finely ground in an oil varnish medium.

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SHOOT-N-TEST Trademark

JOHNSTON FORMATION AND CASING TESTING

that enables you to PERFORATE and TEST IN A SINGLE RUN

The Johnston "SHOOT-N-TEST" Gun Perforator connected to a regular JOHNSTON PRESSURE RECORDER and FORMATION TESTER permits both casing perforating and formation test in a single trip of tubing or drill string.

The JOHNSTON *FORMATION TESTER*

The JOHNSTON FORMATION TESTER is relied upon by operators throughout the world for determining the productivity possibilities of sands encountered in drilling wells as they are penetrated without the expense of setting casing. Its wide range of applications makes it adaptable to every formation testing job on the lease.

The "SHOOT-N-TEST" *GUN PERFORATOR*

The JOHNSTON "SHOOT-N-TEST" GUN PERFORATOR has the versatility to be used solely as a casing perforator or as the perforating unit in combined perforation and test operations. Its design embodies many advanced features to make it the ideal choice for operators desiring utmost safety and efficiency in perforation equipment.

●By unitizing a Johnston "SHOOT-N-TEST" Gun Perforator with a regular Johnston Formation Tester Assembly, any designated formation can be both perforated and tested in one round trip of tubing or drill pipe. The "SHOOT-N-TEST" Gun Perforator is easily connected to Johnston test equipment for combined Perforation and Test operations. Simple top-hole manipulation of the string by the driller readies the Gun Perforator for firing—existing hydrostatic pressure in well trips the firing mechanism.

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"Servicing California-Permian Basin-Rocky Mountain Areas"

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Mechanized Farming

The Anglo-American Oil Co., Ltd., held a reception in London Oct. 26 to inaugurate publication of a manual on "Mechanized Farming." In Great Britain the mechanization of agriculture is seriously outstripping the supply of trained men, and the industry is short of thousands of skilled operators—men not only trained in essentials of farming but men with knowledge of engineering and maintenance to work the evergrowing flood of agricultural machinery. Tractors, robot transplanters and other machines are being produced, but trained workers are not available. Without them mechanized agriculture is faced with a grave handicap in its role of feeding the country and contributing to the improvement of the economic situation. A new phase of education is needed in agriculture. Without the knowledge of how to operate and maintain the complicated and labor-saving machinery, the best use cannot be made of its potential capacity.

Nine foreign oil men were guests of the Los Angeles chapter of Nomads at its October meeting. Seated (left to right): Florent H. Bailly, guest speaker of the evening; Gilberto Capriles, Consul of Venezuela; T. C. B. Vandenberg, American Overseas Petroleum Co.; and O. M. Hulsey, Shell Oil Co. Standing: C. D. Hendershott, Bahrein Petroleum Co., Ltd.; B. R. Wall, Iraq Petroleum Co.; Roy J. Tribbey Jr., Socony-Vacuum Oil Co.; G. H. Atkins, Creole Petroleum Corp., and James R. Gregath, Western Gulf Oil Corp.

In producing this manual on "Mechanized Farming," the Esso organization feels that it is helping to discharge a portion of that responsibility. The manual comprises 118 pages of instructions dealing with the use and maintenance of agricultural machinery and is the compiled work of a team of experts in their particular subjects. It commences with clear descriptions of the fundamental principles on which internal combustion engines, both electrical and compression ignition, work, then goes on to deal with the mechanism of tractors, the choice of them for particular or general work, their specific use in various operations, descriptions of the machinery employed in various operations and the method of employment. Included also in the manual are chapters on choice of fuels, lubricants and rust preventers, as well as the lubrication and general maintenance of engines, tractors and implements. The whole manual is a model of clear writing, and that along with the good and lavish illustrations will enable the untrained or partly trained operator to follow the instructions easily.

Instruction Book for Electric Welders

The Quasi-Arc Company, Ltd., England, has issued an instruction book that provides practical information on the arc welding of various types of steel and non-ferrous metals. The instructions include beginning exercises in making the various kinds of joints in different positions, then follow deep-penetration welding and sheet metal work and notes on the weldability of different metals and how to handle such welds. The illustrations and tables as well as the text are helpful to those without experience in this important kind of work; single copies issued free.

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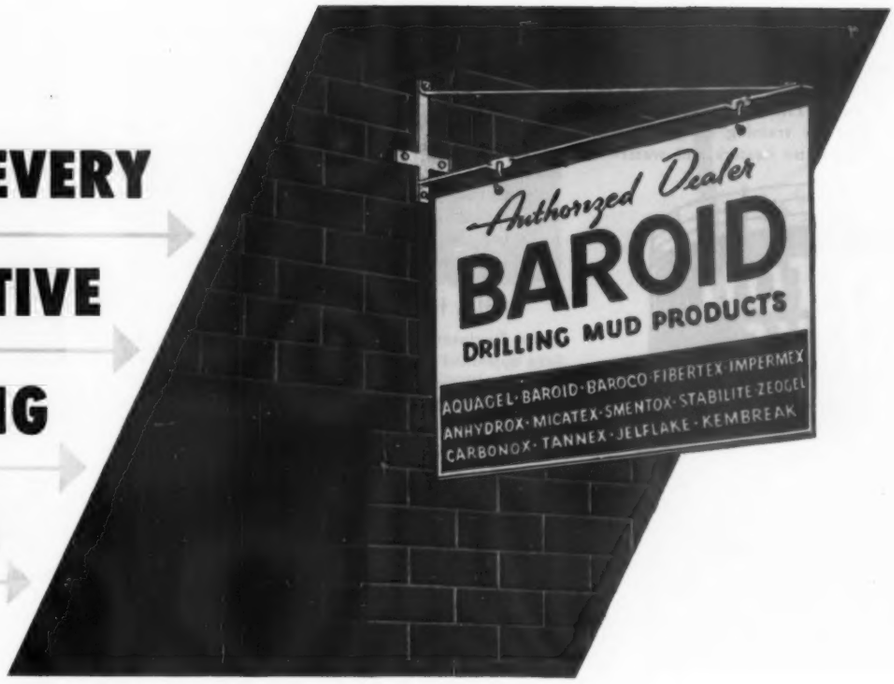
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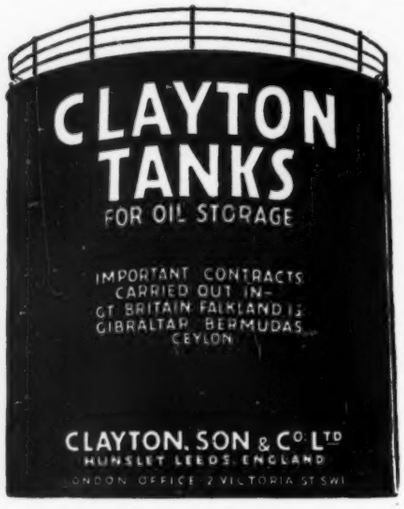
Renews Tail Gas Contract

Standard Oil Co. (Ind.) has renewed for 15 years its contract to supply tail gas from the Whiting, Indiana, refinery to Carbide & Carbon Chemicals Corp. Refinery gas including C_3 fractions have been sold to the chemical manufacturer since 1935 on an increasing scale.

International Students at Worthington Plants

About twenty-five students from opposite ends of the earth are at Worthington Pump and Machinery Corporation's Harrison works for a six-months' training program which began Oct. 1. The students will spend three months at Harrison for training on pumping equipment, condensers, feedwater heaters and water-softening equipment; then two months at Buffalo works for training on diesel and gas engines, compressors and power transmission equipment. At Wellsville, N. Y., and Holyoke, Mass., they will study steam turbines, portable compressors, rock drill equipment and related components, as well as air conditioning and refrigeration equipment. Among the countries represented are Uruguay, China, Chile, Egypt, Cuba, Holland, Siam, France, Mexico and Canada.



Colombians Visit Venezuela

A committee of Colombian officials is to make a ten-day trip to Venezuela to study oil fields in that nation together with administrative aspects of Venezuelan oil and social legislation. Members of the committee are Dr. A. Aragon, minister of petroleum; Senators J. Jaramillo-Giraldo and G. Hernandez R.; Congressman A. Martinez Vega, J. Paramo and Eliseo Arango; and Councilmen F. Mendoza and Juan J. Turbay. Reporters from two daily papers will accompany the committee.

Atlas to Sell Beaumont Products

Atlas Engineering Works, of Houston, Texas, has been appointed exclusive world sales agency for drawworks, wellhead equipment and other producing equipment manufactured by Beaumont Iron Works. Existing sales staff of Beaumont Iron Works will be absorbed by the Atlas sales staff under T. L. Fontaine, president and principal owner of the Houston company.

Ecuador Air Mapping

Hunting Aerosurveys is now engaged in preparing a series of map sheets of 400 square miles of Ecuador for the Anglo-Ecuadorian Oilfields Ltd. This area was photographed by Aerofotos Limitada, a Colombian air survey company associated with Hunting Aerosurveys, and the film sent to the United Kingdom for mapping. The maps are to be used in the geological development of this oil field.

J. T. Gillespie

Gillespie to Manage Watson-Stillman Sales

J. T. Gillespie, Jr., has been appointed general sales manager of the Watson-Stillman Company, Roselle, N. J., it was announced by A. G. York, vice president in charge of sales. The previous sales staff remains unchanged. Mr. Gillespie joined Watson-Stillman in 1944 as director of export sales, in which capacity he remained until appointment to the new post. As part of his new position, he will continue to supervise the company's export sales.

Angus Valve and Seating Cups are supplied in accordance with A. P. I. Std. No. 11A.

Announcing....

ANGUS CUPS

now available

Angus Cups—the first high-grade Valve and Seating Cups of British manufacture—are now available to Oil Field Engineers. Produced from "Gaco" Fabric composition, an extremely tough and wear-resisting compound, with our famous "Gaco" synthetic rubber as the bonding medium.

Layers of fabric are impregnated with "Gaco" and moulded under heavy pressure to form a tough compact composition capable of resisting the action of abrasion, crude oils and gases at high working pressures and temperatures.

Years of intensive research are behind the development of Angus Cups. Supplied in three hardnesses, sizes as laid down by A.P.I. standards.

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Our "Gaco" synthetic material, which achieved a wide reputation before and during the late war as a medium for hydraulic sealing in aircraft and engineering mechanisms, is also now available for the manufacture of other products used in the Oil Industry.

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AGENTS THROUGHOUT THE WORLD

Resume Work in Ethiopia

Sinclair Petroleum Company, a subsidiary of Sinclair Oil Corporation, holding the Ethiopian oil concession, announced today that instructions had been given to resume exploratory and drilling operations in the Ogaden area of Ethiopia. These operations were suspended some months ago because of local disturbances. Since that time agreement has been reached between British authorities and the Ethiopian government for effective police protection, and in view of the energetic measures taken by the government, it is believed that there will be no further interference with the activities of the Sinclair Company. All of the equipment already on the ground is available for immediate resumption of operations.

Canadian Lube Consumption Rises

Sales of lubricating oils in Canada totaled 62,541,921 imperial gallons in 1947, an increase of 7.8 percent over 1946 when the total was 57,999,562 gallons. Motor and tractor crankcase oil consumption rose 8.3 percent to 39,137,106 gallons; industrial oils 5.8 percent to 22,920,562 gallons and aircraft crankcase oils--22 percent to 484,253 gallons.

Another 28,000-Ton British Tanker

The keel of the second of Shell's recently announced 28,000-ton tankers, the largest yet constructed in Britain, was laid Sept. 16 at Messrs. Harland & Wolff's shipyard at Belfast. Construction of a sister ship was begun on July 20 by Messrs. Swan, Hunter at Wallsend-on-Tyne, and the keel of the third vessel is expected to be laid next February at Messrs. Cammell, Laird's yard.

Ben G. Symon

BEN G. SYMON, manager of the lubricants department, Shell Oil Co., New York, was elected president of the National Lubricating Grease Institute at its recent annual meeting at Chicago. Mr. Symon joined Shell in 1928 as a lubricating engineer in the company's St. Louis office. He became manager of the technical products department in 1937 and was named manager of the lubricants department in 1942.

Other officers elected at the National Lubricating Grease Institute's meeting were: vice president, A. J. Daniel, Battenfeld Grease and Oil Corp., Kansas City, Mo.; treasurer, E. V. Moncrieff, Swan-Finch Oil Corp., New York; and executive secretary, H. F. Bennetts.

Appoints Venezuelan Distributor

The fire extinguisher division of Ansul Chemical Co., Marinette, Wis., has appointed Compania Comercial Ultramar, Apartado 1741, Caracas, Venezuela, as its distributor in that country. This appointment brings to 20 the number of Ansul distributors in foreign countries. Nine are in Central and South America. Walter Bitterling is president of Compania Comercial Ultramar.

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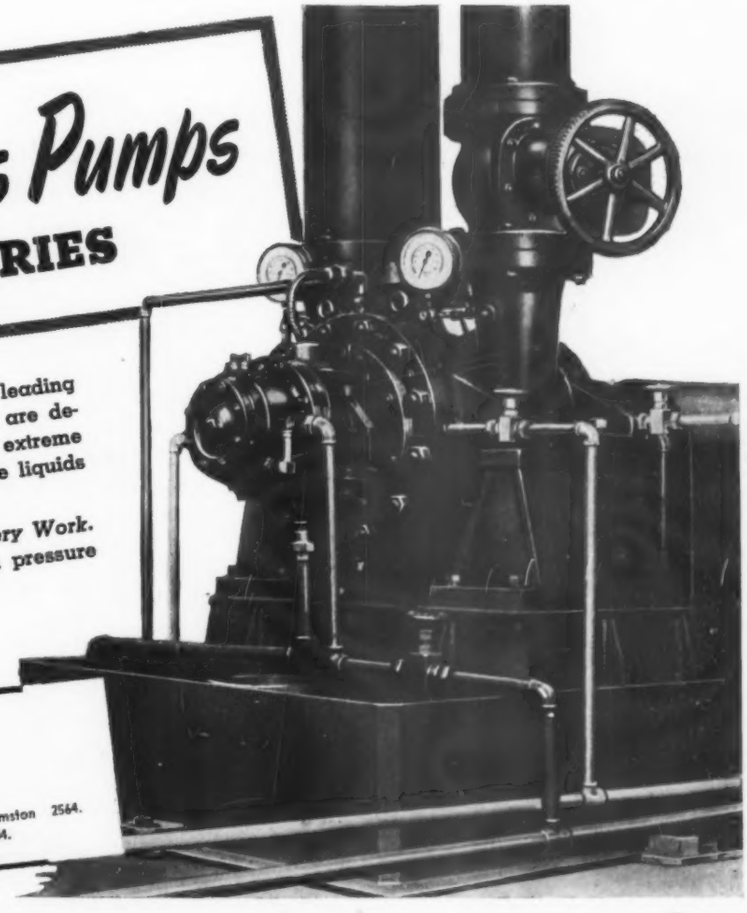
BRANCHES IN PRINCIPAL CITIES

SIGMA *Process Pumps*
FOR OIL REFINERIES



Sigmund Process Pumps are built to the specifications of the leading Oil and Chemical Companies throughout the world. They are designed to deal with difficult pumping problems, where extreme temperatures, high pressures, and corrosive and/or volatile liquids are to be handled. A comprehensive range is available.

This pumping unit is one of many supplied for Oil Refinery Work.
DUTY 1840 imp. g.p.m. against 238 lbs per square inch pressure at 460°F.
MATERIAL 18/18/3 Stainless Steel.

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and at
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Samuel B. Ellis

To Enlarge Export Sales

Samuel B. Ellis has been appointed director of export sales for the Hamilton Rubber Mfg. Corp. Mr. Ellis has had wide experience in foreign marketing. He lived in Shanghai, China, from 1922-1930, where he was engaged in the general importing business. Under Mr. Ellis' supervision, Hamilton plans extensively to increase its foreign sales of mechanical rubber goods.

Appoints Marine Salesman

George H. Kinsman has been appointed marine salesman for the Houston division of Cummins Sales & Service, Inc. He will specialize in power for offshore drilling.

Chlorine Technical Manual

A new technical manual, "Chlorine" has been released by the Columbia Chemical Division of the Pittsburgh Plate Glass Co. Designed for use by operators, technicians, buyers and executives, the new manual presents charts, diagrams and photographic illustrations concerned with the production and handling of chlorine and several of its end-products. Safety precautions, shipping, equipment and construction materials receive detailed consideration. The technical data section presents a minute story of the properties of chlorine. Copies are available by writing to the firm's offices, Fifth Ave. at Bellefield, Pittsburgh 13, Pa.

Opens Tulsa Office

Announcement is made by E. K. Anderson, Cutler-Hammer Dallas district sales manager, of the opening of a new branch sales office located at 533 Mayo Building, Tulsa, Okla. B. R. Stratton will manage the new office as a branch of the company's Dallas district sales office.

To Distribute Milwaukee Chains

The Continental Supply Company has been appointed a distributor for oil field chains manufactured by Chain Belt Co., of Milwaukee. Stocks of both Rex API chains and Baldwin-Rex roller chains will be available at all the Continental company store points.

Projected Spanish Refinery

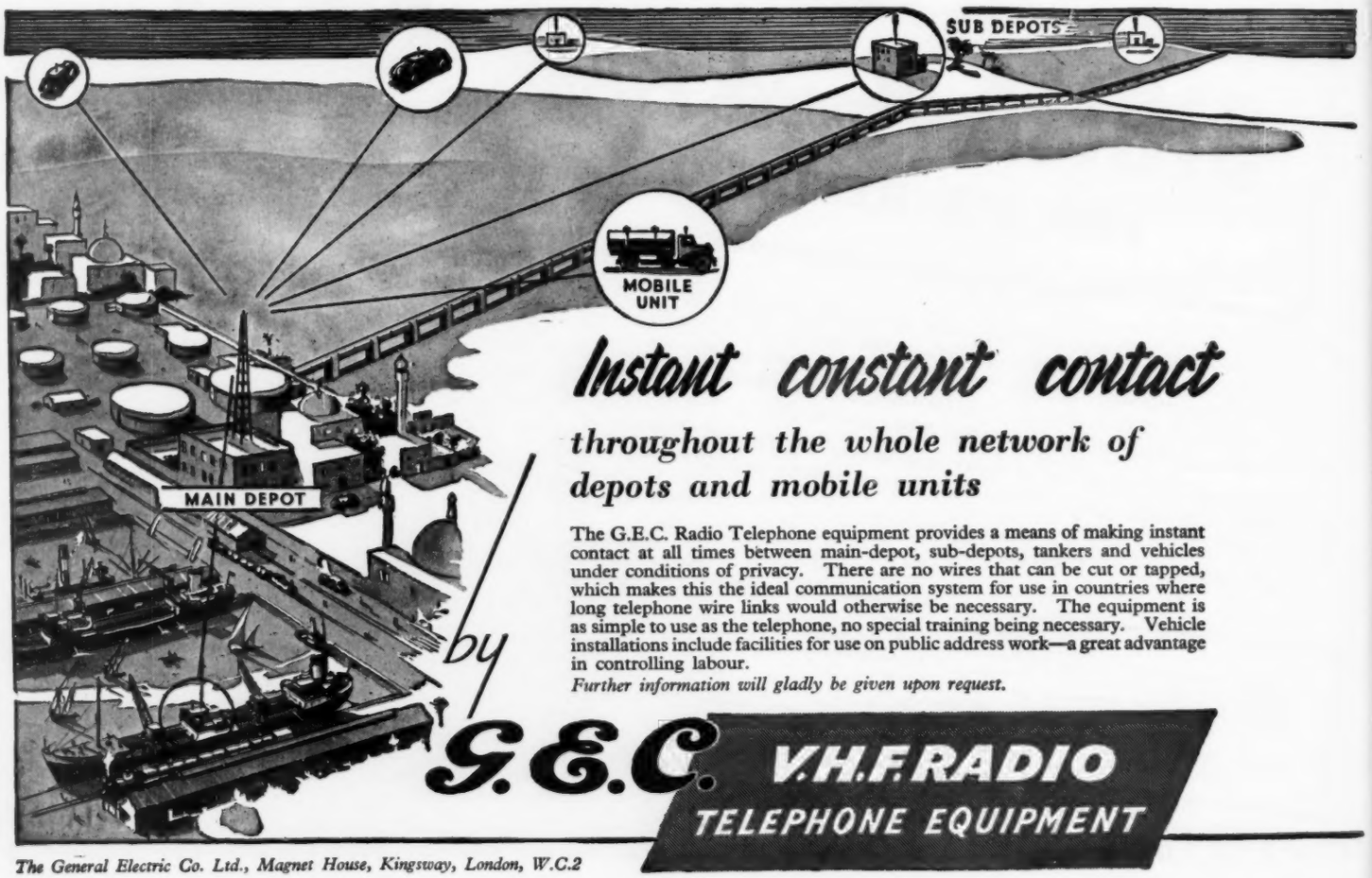
For several years the shortage of petroleum products in Spain has been a matter of serious concern to the government, and plans have been reported from time to time for the building of one or more refineries to be fed by imported crude. Spain's only modern refinery at present is located in the Canary Islands and is operated by Cia. Espanola de Petroleo S.A. (Cepsa), which is the refining branch of Cia. Arrendataria del Monopolio de Petroleos S.A. (Campsa), which has had exclusive rights in the Spanish market under contract with the government. Its 20-year agreement expires this year, and negotiations have been under way for a five-year extension.

Last month it was definitely reported from Spain that a new refinery, probably of 20,000 barrels daily capacity, would be constructed at Cartagena, on the Mediterranean coast under joint ownership of the Institute Nacional de Industria, a government organization, California-Texas Oil Co., Ltd., and Cepsa, the former holding a 52-percent interest and the two latter 24 percent each. It was also stated that the refinery would operate on Middle East crude. While officials of California-Texas have declined to deny or affirm participation in the undertaking, the report appears to be accepted as fact in Spain.

Plans for enlargement of the Teneriffe refinery of Cepsa from 12,000 to 13,000 barrels daily capacity have been under consideration for some time, but execution has been delayed, reputedly by inability to obtain materials and equipment. Whether these plans will be affected by the new project is not known.

Correction

In an article dealing with domestic fuel oil supplies carried in the October issue of World Petroleum, it was stated that "Shell Oil Co. has developed its own burner for sale to other manufacturers." Shell's development is not a complete burner, but rather a combustion head which the company licenses burner manufacturers to use on a royalty-free basis. A recent list published by Shell reveals that 19 manufacturers have taken licenses under the oil company's patents. The combustion head is said to save 14 to 36 percent on fuel bills.



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Further information will gladly be given upon request.

by G.E.C. V.H.F. RADIO TELEPHONE EQUIPMENT

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